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DEVELOPMENT of our product is going on constantly. Electrical equipment of changed design is being put into new models of automobiles, and the changes in design mean changes in shop equipment. The performance of automobiles is being improved, and at the same time weight and price are being reduced. Lighter and less costly, yet more efficient, electrical units must be provided. Economical production alone makes possible the profitable fulfillment of such requirements and it is largely upon shop equipment that economical production depends

Getting the Most Out of Your Machine Tool Dollar

By G. T. Christopher
Factory Manager
Dayton Engineering Laboratories Co.

OBSOLESCENCE as applied to productive machine tools is the result of the elimination of uneconomical manufacturing operations. An operation may be done away with entirely, it may be transferred to a machine of greater production, better cutters may be used, or more suitable fixtures may be applied; whatever the step taken, the object is to get away from the wasteful in manufacture.

Not every step toward economy in production means the obsolescence of machine tools, but each step tends in that direction and many bring that result directly. When a machine is superseded by one capable of greater output, it has been started on the path to obsolescence. When better cutters or fixtures are applied, it is quite likely to be found that the machine is not capable of the added productivity that is certain to be demanded.

Ordinarily the influences toward the obsolescence of machine tools are quite different from those affecting such commodities as automobiles and clothes, where appearance, style and variation are the chief factors that control purchasing. Yet those same influences really are at work in the Delco plant in relation to machine tools for the reason that they are at work on our product, which is electric lighting, starting and ignition equipment for automobiles.

Development of our product is going on constantly. Electrical equipment of changed design is being put into new models of automobiles, and the changes in design mean changes in shop equipment. The performance of automobiles is being improved, and at the same time weight and price are being reduced. Lighter and less costly, yet more efficient electrical units must be provided. Economical production alone makes possible the profitable fulfillment of such requirements and it is largely upon shop equipment that economical production depends.

When the Delco plant was started, the machine tools purchased were as modern as could be afforded, with due consideration given to the production required, at that time necessarily very small. The machines were given shop numbers for identification and history cards were made, showing the purchase price, the cost of installation and the cost of applying motive power, with space provided to show the charges for all maintenance and overhauling expense.

Those charges have been entered and the system of card records has been kept up on all equipment bought during the life of the plant, so that at all times we have known our cost per productive hour of operation. The existence of these records has made it easy enough to decide whether or not a machine is economical for the production loaded on it.

In this connection we carry what is known as a machine load chart. For instance, consider automatics. We have four makes of up-to-date machines, ranging from the single-spindle to the five-spindle type. For some diameters of work there are four types of machines available. From our load chart we know what each machine is capable of doing, and so it is not difficult, as our requirements on certain parts change, to figure out whether or not the equipment will take care of the productive hours required to maintain our schedule. Because production demands frequently increase, it is not unusual for us to take a job from a single-spindle

machine, economical up to a given point, and place it on a multiple-spindle machine. We are then forced to check the work for our single-spindle machines to see whether we have loads sufficient to justify carrying them or must class them as obsolete for our purposes and dispose of them.

If the load chart shows that, in transfer of operation or in change of design, our machines to produce the new or changed parts are overloaded, we refer to our machinery record to find the actual cost of the production hours of the machines. In deciding to continue or replace them we always consider the total hours that a machine has been operated and whether it has been in service on two or three shifts.

Equipment that has been classed as obsolete is disposed of in two ways, so far as the production departments are concerned. The foreman of the department sends the machines to the salvage department either tagged to be held for a certain length of time, or not tagged, indicating that there is no further chance of their being used. If tagged machines are not requisitioned for further production work before the expiration of the "hold" time, they are classed as obsolete when that time arrives. The salvage supervisor then disposes of them, as he does of the machines that reach him without tags, by selling or scrapping them.

Considerations in Buying Equipment

In giving consideration to machines with the object of adding them to our equipment either to increase capacity or to replace other equipment, we take into account a number of points that affect the immediate and potential value of the tools:

1. The extent of the field of application of the machine to our work. Examples: chucking machines on turret lathe work to be available to be switched over to wire-feed or bar-feed equipment; gear cutters that will cut spiral, straight, spur and shoulder gears, or gang arbor work.

2. If standard, how readily adaptable to special tools and fixtures. Is the machine standard to a point where, if the part on which it is used should be taken out of production, it could be changed into a fully standard, saleable machine tool by supplying the necessary parts? Examples: External grinders are machines that are standard except for the work head. Boring mills and drills are standard except for feeds.

3. Probable life of the machine, considering all types of work on which it would be used. Example: If a precision machine is required for certain accurate work, is it sturdy enough to be placed on production work after it has served its useful life as a precision machine? In other words, the machine is considered from the standpoint of departmental transfer.

4. Possibility of the parts produced being changed as regards the selection of material. Example: For two years our multiple-spindle bar automatics on stock of 3¼-in. diameter have been inefficient because of the tendency in design to use forgings, in machining which automatic chucking machines are more efficient.

5. Accuracy of production. Will the machine continue to produce a large percentage of good pieces regularly? Is the accuracy, particularly on automatic work, sufficient to permit of some finishing operations, thereby cutting down on second-operation work?

6. The amount of production required. On some work we have found it economical to maintain obsolete designs of machines to produce small quantities that repeat frequently on the schedule. The set-up is never disturbed, and of course no job-setter is required. On some of our automatics the set-up time amounts to as much as seven hours on parts that require approximately two hours for machining the lot. Some of the schedules on this class of work repeat as often as every thirty days.

On small-lot production, when special tools are required, it is often more economical to use a machine of relatively low production and low cost than a high-production machine with a smaller unit of direct labor. In forming conclusions as to the type of machines to install, there must be considered the cost of tools, depreciation on the machine, interest on the investment, obsolescence and other carrying charges.

7. Reduction in process inventory. For medium production requiring complicated set-ups we have found it economical sometimes to carry an underload on equipment in order to process operations so that we can require or allow less time in the channels of production for our materials. The additional equipment maintained is justified by the more rapid turnover of inventory. Since the carrying costs on equipment are charged against individual departments, and each department has its own overhead, a foreman is very much interested in getting by with as small an amount of equipment as he can.

We considered it a good business proposition if a machine, or machines when we use a battery, will save the purchase price in the period of one year. Because of changes in design and requirements of what we have to sell, we have found that the period of one year is the safe length of time during which we can turn out our product and at the same time wipe out our initial expenditure. We do not write off our machinery investments at that rate, but we do hold to that rule in replacing machinery.

Influence of Repair Costs

In the seven points that I listed for consideration in buying equipment I did not include the repairing of machinery. At best there can be only a guess as to what repairs to new equipment will cost. However, records of the cost of repairs to equipment in service are kept and we at least know that new machines are likely to be much less expensive in that respect than are machines that have been in service for some time. Our repair cost records therefore serve as a guide as to the time when a machine should be placed in the obsolete class. They serve also as a guide in the matter of rebuilding, of which we do probably more than the average amount. We consider repair costs so important that we budget the payroll of the repair department monthly, projecting the budget three months ahead. The budget is based on productive labor according to our output schedule. When the cost of the repair payroll exceeds the budget allowance, one or both of two things must be wrong. Either our repair gang has not worked efficiently or we are repairing where we should be buying, or both. Since we are able to check our repair labor very closely, we are most likely to find that we are nursing along some machines that we should be better off without.

Before concluding the article I shall tell of the steps taken in originating an order and putting it through to the machine tool builder. I shall also point out what to us are the chief faults of machine tools. But before doing so, I present the following example of a recom-

mendation for the purchase of equipment, in order to show how the cost of repairs and our records of repair costs enter into our calculations when buying:

Mr. G. T. Christopher,
Factory Manager.

We have instituted a request for appropriation for $111,200 to cover the purchase of three (3) No. Y John Doe Co. screw machines and tools for three of our piece parts.

We arrived at the advisability of the purchase of these, first, by taking five of our representative parts. We find that at the present time we are loaded 160.2 hours to produce the schedule on these pieces. From the Doe Co.'s estimates, we figure that we can do this work in 76 hours.

The repair on our No. X Doe machines will cost approximately $1,200 each to put them in good shape and we have been spending on an average of $280 per year per machine for repair parts, while the new machines should not cost more than $80 for miscellaneous repair parts.

These findings are considered along with other items, of which a summary follows:

Machines on books @ net of	$ 355
Salvage	200
Loss per machine	155
Loss per six machines	930
Three new machines cost	9,600
Installation, freight, etc.	400
	10,000
New tools	1,200
	$11,200

Savings, First Year

Repair of 6 machines @ $1,200	$ 7,200
1 operator, 50 weeks @ $40	2,000
Savings in repair parts	1,450
	10,650
Less loss on sale of equipment	930
Net savings in operation	$ 9,720

Savings, Second Year, Etc.

1 operator	$ 2,000
Repairs	1,450
	$ 3,450

J. F. WHELAN,
Research Engineer.

This recommendation is a report made by the research department. The request for the equipment, however, originated with the foreman of the department concerned. All of our requests, or "orders" are made to originate with the foreman. That statement may sound peculiar, but it means just what it says. The reason back of it is our policy of not cramming equipment down the throats of the foremen. Perhaps I may learn of a piece of desirable equipment first, or perhaps the research engineer may, but the request will originate with the foreman.

Like all progressive concerns we are alert for new designs and new methods. We discover them by experimenting, or we learn of them through the usual channels —technical magazines, salesmen, visiting. When the desire for the equipment has been expressed in the form of a request for it, the research department makes an investigation of its possibilities and writes a report to the factory manager. When the evidence shows that the equipment is needed, the factory manager OKs the request and instructs the purchasing department to prepare the order. He then signs the order, which the purchasing department issues and follows up.

So much for our methods of dealing with shop equipment. Now for the shortcomings of machine tools: From our point of view they are few, and it must be kept in mind that the criticisms are based on experience with a specific kind of product. Ninety per cent of the machine tools have too wide a range—too many feed gears and too many changes of speed, and there is not enough oiling capacity, by which I mean that they must be oiled too frequently. In general those are the faults. To be more specific, let me point out that for our kind of work high speeds and rather low feeds are used. Cuts as a rule are light, and the limiting factor is the work, not the tool.

I have no doubt that the equipment problem has variations in each shop. Certain it is that in every shop it is of paramount importance. It should not be neglected or treated in a haphazard way. Obsolete machines are a detriment that can be overcome by the use of very ordinary cost and production records. It is my experience in quantity production work that modern equipment is a necessity.

[The preceding article is the fifth under the title, "Getting the Most Out of Your Machine Tool Dollar." The first article, by J. A. Smith, General Superintendent of the General Electric Co., Schenectady, N. Y., was published on page 409. The second, by C. A. Shaffer, General Supervisor of Machinery and Tools of the Illinois Central Railroad, was published on page 521. The third, by Robert F. Runge, Vice-president of SKF Industries, Inc., was published on page 719. The fourth, by L. C. Morrow, Managing Editor, *American Machinist*, outlining the policies of the International Harvester Co., was published on page 793. Other articles on the same subject will be published in forthcoming issues.]

Pertinent Ideas on the Cutting of Threads —Discussion

BY RALPH E. FLANDERS

In an article under the title given above, by H. R. Fowler, and published on page 399, Vol. 62, of the *American Machinist*, there is clearly set forth one of the most serious obstacles to the cutting of good threads that exists in general machine shop practice today.

The original screw thread report did not make definite and adequate provision for enlarging the minor diameter of screw-thread gages. It is, I suppose, for this reason that some of the leading makers of gages have not yet enlarged this minor diameter to the point permitted by the dimensions of the root of the American National form. A number of firms have enlarged the minor diameters of their gages, but one or two, and among them at least one of the most prominent, still lag behind and give cause for just the difficulty so well described by Mr. Fowler.

A second revised report of the National Screw Thread Commission in which this matter is definitely taken care of has just been issued. In this report, authority is given for the proper enlargement of the minor diameter of ring gages, and proper dimensions and tolerances are given for that enlargement. We can all hope that now the matter has been settled, the gage makers who have not already done so will conform to the new requirements and save the rest of us a good deal of annoyance.

Intelligence in Machine Design —Discussion

By W. R. Needham
Essex, England

ENTROPY'S original contribution under the title given above and published on page 928, Vol. 61, of the *American Machinist*, is stimulating and thought provoking. His strictures on some designs are not at all too drastic. In fact it is only by courtesy or the convention of mere word, that certain so-called designs can be so named at all. They are not in the literal sense designs. They lack destinction, they only function passably well and they are costly. They hurt the designing sense of the bona fide designer.

Of course it is not every man in a designing or drawing office who is really a designer. Many of them are fish out of water. Not a few of them are first rate cartoonists, slugging away at the wrong job; others are, potentially at least, excellent salesmen, who instead of selling a good article, help to produce an indifferent, if not a bad one. And yet many of these mis-fits are great triers. The writer has in mind a youth he knew years ago. This young man hoped great things for himself, tried hard, read books that he quite failed to understand and yet he became, or remained, just a super-tracer. If the youth found an engineering career —especially on the technical and design side—unremittingly monotonous and irksome, he should have sought more congenial employment.

Broad Viewpoint Essential

For the men who love engineering, and whose mental bent is all that way, things are altogether different. Even they, however, need practice and good training. It is a question of principles more than anything else. They should not despise certain broad rules and landmarks. In particular they should encourage a wide outlook. They need to have more than the drawing- or design-office point of view, or one that will include the production and the sales aspects also. This is admittedly a tall order, but real design is no mere departmental affair. Whether he has had the advantage of an actual workshop and commercial training or not, the designer should know sufficient of the larger issues involved. It is not enough that a design shall do the thing intended. That design must be a paying proposition. Money must not be thrown away. This means that the designer must know, at least broadly, the principles underlying pattern making and molding, the various machining operations, smith work, fitting and assembling; and also he should keep in mind that sales have to be effected under modern competitive conditions. The matters affecting strengths of material will certainly be within his own province, unless he be a mere copyist. Even here he needs to keep abreast of the times. He should know something of the trend of research, and be wide awake to record actual applications on a really commercial scale. He should also be acquainted with relative costs of materials and operations. Yet another desideratum—and perhaps one of the most important—is that he consult with those directly concerned in production, in purchase, and in sales. Many a good design is improved in incidentals when the man responsible solicits the views of those in charge of the execution of the actual work. Certainly many an indifferent design might be bettered were such an essentially sane and common sense procedure adopted. Not least among the benefits that accrue is the spirit of good will and helpfulness engendered as between departments. Internal friction is as bad in an engineering concern as in a machine.

The burden of this pleading has reference, of course, to the draftsman or other designer who is really a bona fide *designer*. But the draftsman who is not a designer is not worth his salt. He has opportunities to make good. If he be but a detailer for the nonce, there is scope in the incidentals. He should satisfy himself that what changes he proposes are an improvement, then make his sugestions. Sooner or later, if he knows the inwardness of things, his chance will come and he will not remain a detailer. In the meantime, let him keep his eyes open, his brain active, and let him soak in the various shop aspects of the work he has in hand.

Needless to say, the chief draftsman, or free-lance designing draftsman, ought to know these things and ought to realize the extreme importance of them. Often men do the first, and in practice shelve the second. The chief at least, should be equally at home in the office and in the various works departments, and should be in touch with the purchase and sales staffs.

The young draftsman especially, should be made to realize that a drawing is not something apart. His working drawings represent actual things that are to be made and worked upon in one or more of various workshops. Thus, questions affecting the molding of items which are to be cast, the machining of castings and forgings, the facility with which parts are put together and taken apart, are of front rank importance. He should know that when several methods are possible, one may be cheaper and simpler in manufacture and operation. He should be made to realize that the ideal is soundness and simplicity, coupled with the highest efficiency. Of two alternatives, one requiring a score of components and machine shop operations to correspond; the other reducing these requirements by half, both as regards parts and service—there can be no question as to which is preferable. The designer should seek the knowledge by which he may not only choose aright when the alternatives are placed before him, but also that by which he can visualize those alternatives himself.

More Pay for Workmen Through Waste Elimination

The greatest opportunity for increased wages and higher standards of living for the worker lies in eliminating industrial wastes, according to Herbert Hoover, Secretary of Commerce, in an address delivered at the Industrial Round Table of the National Civic Federation. These wastes can be reduced only by collective effort.

"They contain," he declared, "the paradox that if we save collectively, we will have more goods and services to expend individually." Illustrating the possibilities, he commented on the fine showing of our railways in the last three years. They have handled a 14 per cent increase in gross operating expenses. Rates have been decreased over 5 per cent, the hours of the workers have decreased and the wage has increased slightly. Service to the community has been immeasurably improved, and all this due to great effort in management, and the cooperation of the employees and of the community itself.

Startling Results in Surface Grinding

By Fred H. Colvin
Editor, *American Machinist*

Fourteen examples that show a large variety of work and give data as to the results obtained—Wheels and feeds used are given in each case

THE progress that is being made in the grinding field is nowhere better exemplified than in the work done by the Blanchard Machine Co., Cambridge, Mass., in developing the surface grinder into a machine for removing metal in very appreciable quantities and at a rapid rate. Instead of considering the grinding machine as a machine for finishing only, much time has been devoted to developing it to grind pieces from the rough, and so eliminate on some parts the preliminary machining operations of planing or milling, that were previously necessary.

In some cases, as in Fig. 1, where the design is such that the pieces will not stand a heavy cut, the use of the grinding machine does not seem so unusual. The size of the round flasks shown can be seen from the rule to be over 36 in. in diameter. Yet they are ground on both sides at the rate of 8 per hr. and to within 0.002 in. plus or minus. The magnetic chuck makes it easy to load and hold the work and enables the flasks to be chucked and released as rapidly as they can be handled, which accounts for the speed of handling. The table speed is 13 r.p.m. and the downward feed of the wheel 0.003 in. per revolution of the work. A 24-I, silicon carbide wheel was used.

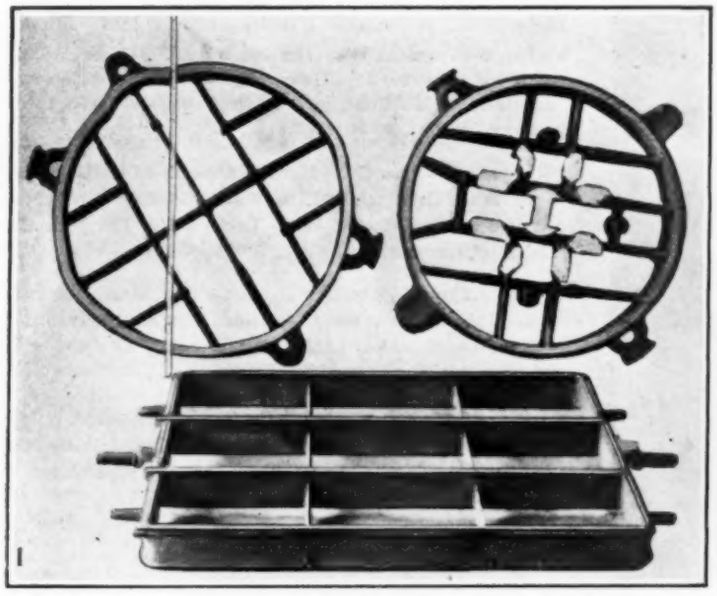


Fig. 1—Foundry flasks ground on both sides.

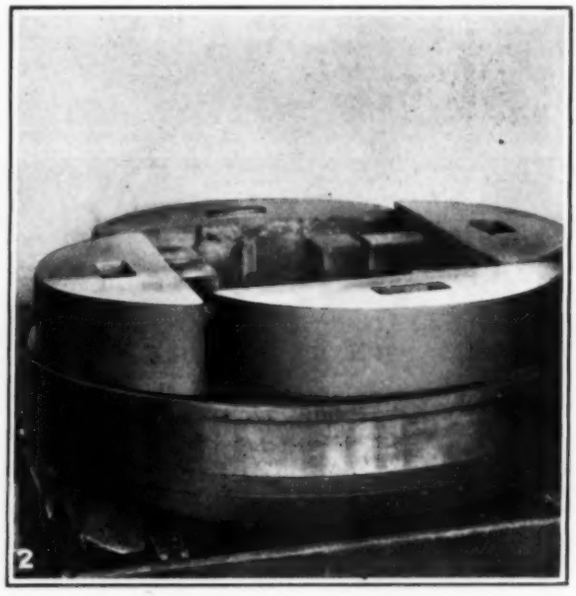
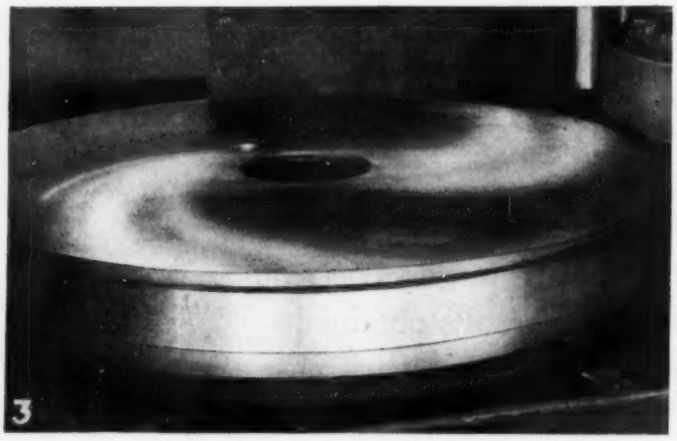


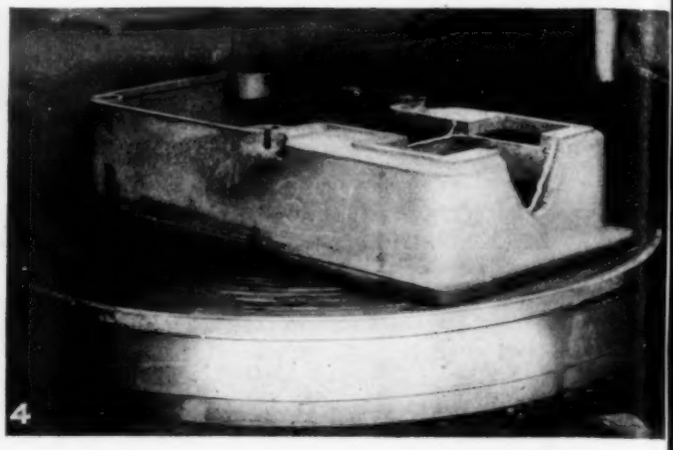
Fig. 2—Grinding four counterweights at once

Perhaps the most striking example of heavy-duty grinding is shown in Fig. 2. The table holds four cast-iron counterweights, 29 in. long, 16 in. high and 7⅞ in. thick. The counterweights are ground on both sides, the depth of cut being ⅛ in. per side. When we consider the size and weight of these pieces, it is difficult to realize that they can be surfaced on both sides at the rate of 6 pieces per hr., and to a tolerance of 0.002 in. Here again, the ability to chuck these pieces on a horizontal table and to hold them by the magnetic chuck, is a very important factor in the total time required. Then, too, the fact of removing ⅛ in. of stock by grinding would have been considered practically impossible a few years ago. The table speed is 13 r.p.m. and the downward feed of the wheel is 0.002 in. per revolution of the work. A 20-H, silicon carbide wheel was used.

The data given are from the large Blanchard machines that swing up to 85 in. and carry wheels of from 27 to 36 in. in diameter, and in one case at least, up to 42 in. The use of this type of machine on such work as sharpening dies, Fig. 5, has the advantage of having a flood of water that eliminates the possibilities of burning the die. This increases the life of the die sometimes as much as 100 per cent.

The automobile cylinders, Fig. 12, are ground flat within 0.0005 in. on a production basis. The heads are also finished in the same way. Figs. 13 and 14 show one of the greatest savings. These operations were formerly done by hand filing and required from 4 to





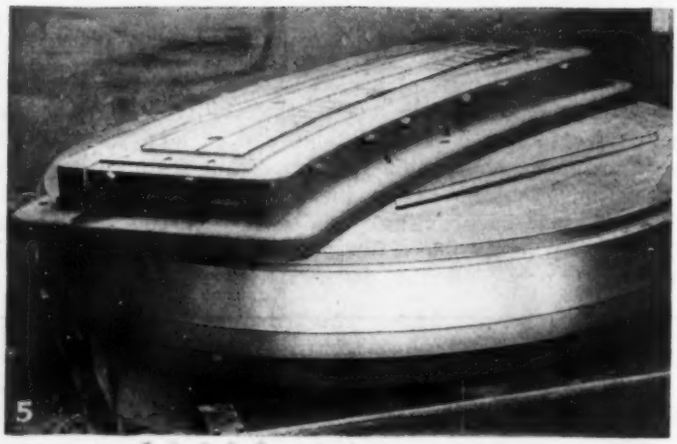


Fig. 3—Turbine Disk. Carbon Steel. Diameter, 53 in.; hole, 1 in.; thickness, 1 in. Two sides ground. Stock removed per side, 1/16 in. Limit, clean up. Production, 1 piece per hr. Table speed, 5 and 3 r.p.m. Down feed 0.001 in. per rev. Wheel, 30-H silicate

Fig. 4—Winch Base. Cast iron. 41x20¼x8 11-16 in. Both sides ground. Stock removed per side, 3/16 in. Limit, clean up. Production, 5 per hr. Table speed, 13 r.p.m. Down feed per rev., 0.003 in. Wheel, 24-I Silicon carbide

Fig. 5—Segment Die. Hardened steel. 54x20x5 in. Stock removed, 0.020 in. Limit, clean up. Production—Total grinding time, 5 min. Table speed, 13 r.p.m. Down feed, 0.001 in. per rev. Wheel, 30-H silicate

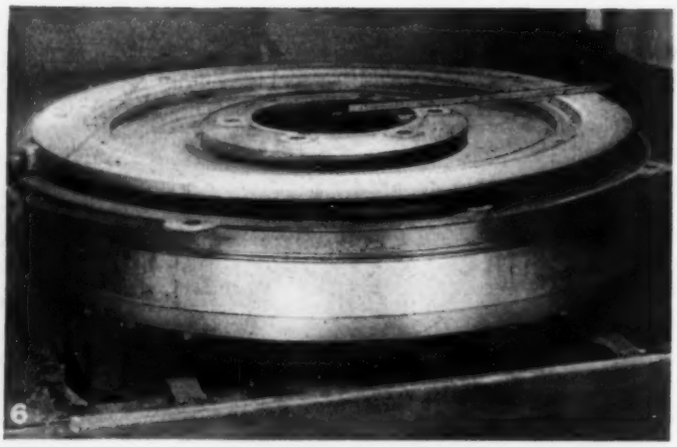
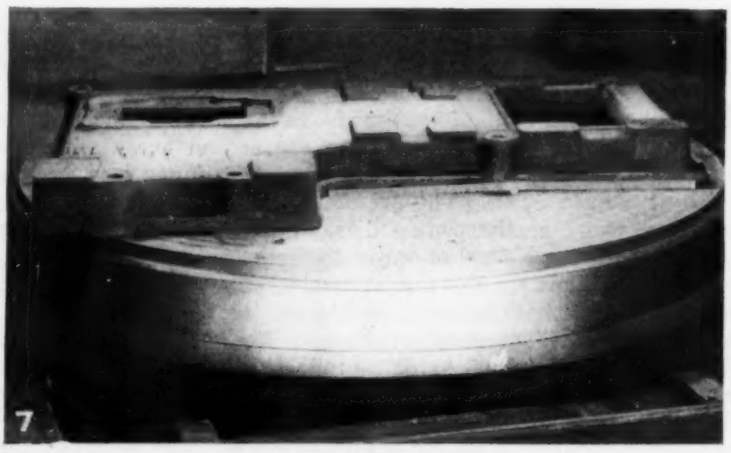
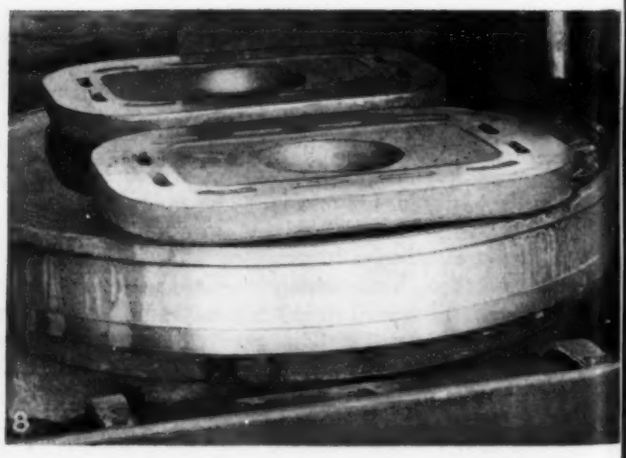


Fig. 6—Circular Die. Hardened steel. 54 in. O. D., 13 in. I. D. Stock removed, 0.015 in. Limit, clean up. Production—Actual grinding time, 5 min. Table speed, 13 r.p.m. Down feed, 0.001 in. per rev. Wheel, 30-H silicate

Fig. 7—Elevator Base-Plate. Cast iron. 57x33 in. Ground both sides. Stock removed per side, 3/16 in. Limit, clean up. Production, 5 per hr. Table speed, 13 r.p.m. Down feed, 0.003 in. per rev. Wheel, 24-I silicon carbide

Fig. 8—Muffler Flanges. Cast iron. 31x21x3½ in. Both sides ground. Stock removed per side, 5/32 in. Limit, clean up. Production, 5 per hr. Table speed, 13 r.p.m. Down feed, 0.002 in. per rev. Wheel, 20-I silicon carbide





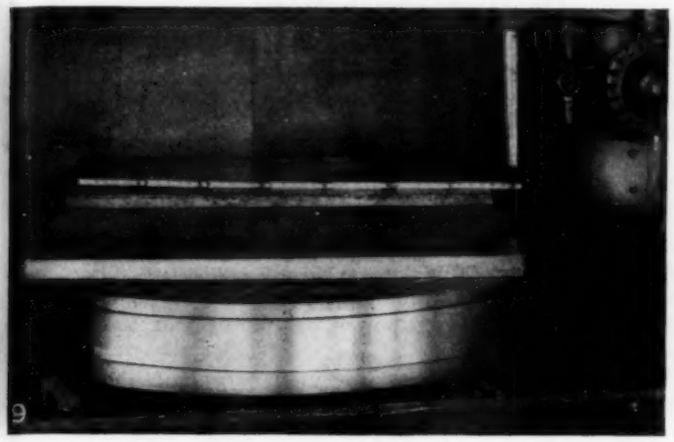


Fig. 9—Mold Plates. Soft steel. 40x20x1¾ in. Both sides ground. Stock removed per side, ⅛ in. Limit, ± 0.002 in. Production—Time per piece, 78 min. Table speed, 5 r.p.m. Down feed, 0.001 in. per rev. Wheel, 24-H silicate

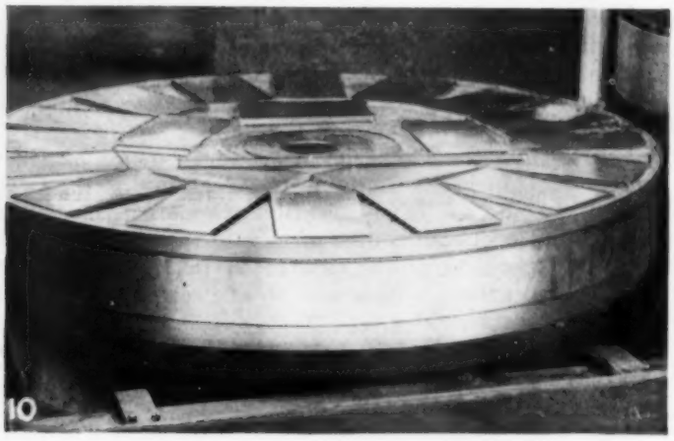


Fig. 10—Diaphragm Plates. Nickel steel. 9⅞x5⅛x⅜ in. Both sides ground. Stock removed per side, 1/32 in. Limit, ± 0.001 in. Production, 50 per hr. Table speed, 8 r.p.m. Down feed, 0.0015 in. per rev. Wheel, 30-H silicate

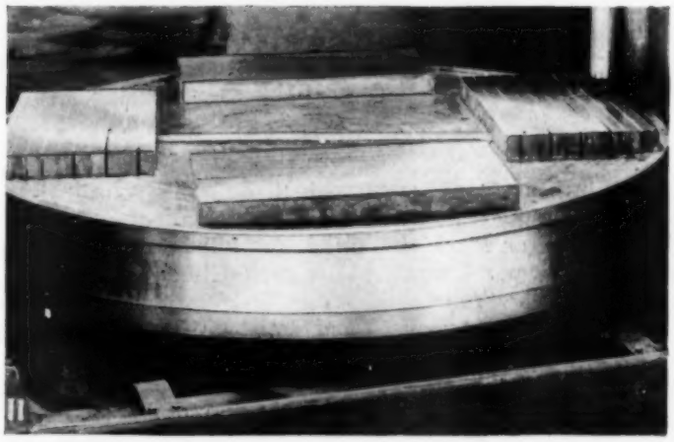


Fig. 11—Turbine-Blade Blanks. Nickel steel. 19½x1x1⅛ in. Both sides ground. Stock removed per side, 1/32 in. Limit, ± 0.001 in. Production, 45 per hr. Table speed, 8 r.p.m. Down feed, 0.0015 in. per rev. Wheel, 30-H silicate

Fig. 12—Cylinder Block. Cast iron. 30¾x7x9⅛ in. Ground top and bottom. Stock removed per side, 0.015 in. Limit ± 0.0015 in. (Ground after rough milling.) Production, 32 per hr. Table speed, 8 r.p.m. Down feed, 0.0015 in. per rev. Wheel, 20-H silicon carbide

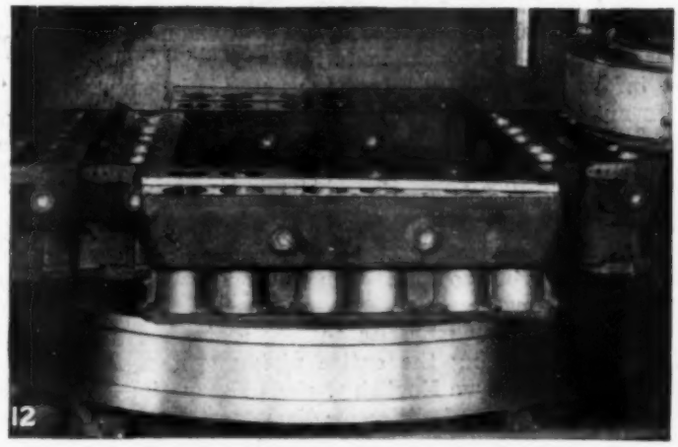
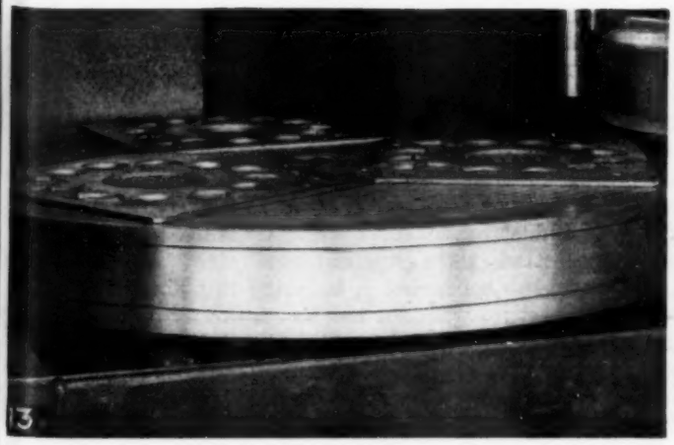
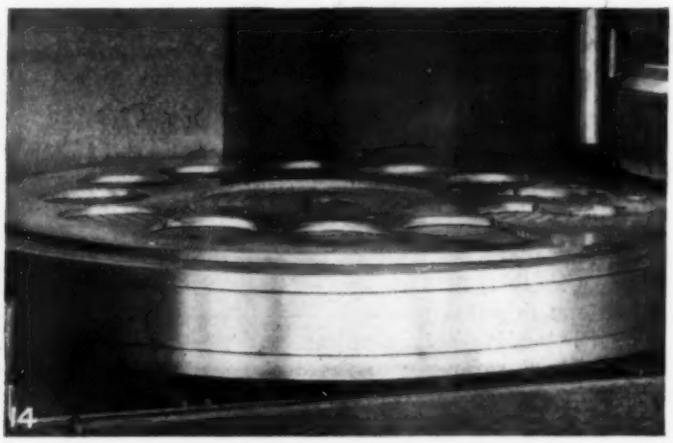


Fig. 13—Braiding-Machine Carrier. Soft steel. 22¾x20⅞x 5/16 in. Both sides ground. Stock removed per side, 0.020 in. Limit, ± 0.001 in. Production, 12 per hr. Table speed, 8 r.p.m. Down feed, 0.002 in. per min. Wheel, 24-I silicate

Fig. 14—Braiding-Machine Carrier. Soft steel. 50 in. diameter, 9/16 in. thick. Ground both sides. Stock removed per side, 0.015 in. Limit, ± 0.001 in. Production, 3 per hr. Table speed, 8 r.p.m. Down feed, 0.002 in. per rev. Wheel, 24-I silicate





7 hr. There is, of course, no comparison as to the accuracy or quality of the finish. In the other illustrations, are shown examples of the application of the grinding machine to work formerly done in other ways.

Taken as a whole these fourteen examples are sufficiently out of the ordinary to bring our attention forcibly to the changes that have taken place in machine shop practice. Both the development of the grinding machine and of the abrasive wheels used are due to many weeks and months of careful research and experiment. And, as in the case of the machine and the high-speed cutter, neither can be of greatest value without the other.

The grinding machine has made a distinct place for itself in modern manufacturing, both for plane and cylindrical surfaces. And still further development may be expected from time to time.

Put Full Information on the Drawings —Discussion

By J. T. Towlson
London, England

I am in hearty agreement with R. B. Willis, who in an article under the title given above, on page 358 of the *American Machinist*, pleads for full information on drawings, and I would put a special high-powered emphasis on the "full."

Having served as general and detail draftsman myself, I feel sure that the resources of the draftsman's profession are fully equal to the task of placing on the drawing itself every particular in the way of information that may be needed by the men who are to execute the work, and I believe that should it be necessary for these men to ask any question of the draftsman or engineering office, such question is in itself evidence that the information conveyed by the drawing is incomplete.

In my own experience I have many times been hampered in the execution of my work because of inadequate instruction, many details having been omitted from the drawing by the less experienced draftsmen. On the other hand, I have seen many jobs come into the shop accompanied by drawings that were complete in every particular, leaving no detail open to discussion and consequent time wasting.

As an example, I may cite one job that came to us, that of constructing the entire piping system for a large and well-known English works. Every pipe—and there were miles; of different diameters, shapes and lengths; with twists, bends, tees and crosses, with valves, cocks and special fittings, all complete—was shown in detail on the prints so that every foot could be made up in the shop, and of course at far less expense than at the site of the job.

In most unpleasant contrast to the foregoing was a similar job for another factory. There was just one drawing—a layout of the plant drawn to a scale of ⅛ in. to the foot—and, though the system was fully as complicated as in the other example, not one detail was given. To make matters worse the designer was 500 miles away and there was not one line of written instructions to guide us.

Notwithstanding this handicap, the work was completed without reference to the designer, though at a cost far in excess of the amount that might reasonably have been expected had the designer seen fit to put proper notations on the drawing.

Drafting Instructions

By John F. Hardecker
U. S. Navy Yard, Philadelphia, Pa.

Jack Brown and Bill Smith, chief draftsmen of two large manufacturing concerns, were having a friendly discussion while lunching together concerning "personal problems." "Jack," said Bill, "I've got a man right now who has been a mighty good designer for us for quite a number of years, and yet, now that I've put him in charge of a squad, I am very much disappointed with his results. Though he's well liked, somehow he doesn't get the production out of his men that I feel he should."

"Well," said Jack, "my answer may be only a shot in the dark, but since it's his first venture as a squad boss, and he has been a designer right along, may be he doesn't know how to give instructions to his men. I've found in several cases that these designers haven't got the knack of outlining the entire job to a detailer, but sort of deal it out to him piecemeal. In fact, they keep telling him just how to do his job, step by step, give him such minute instructions that they are only utilizing his hands on the job and giving his head an unneeded and unwarranted vacation. The result is that the detailer has no known objective, but is just trying to remember his way from one line to the next. Besides slowing up the work considerably, it generally means that any oversights or errors in the designer's work don't show up until the job is practically done. It certainly retards the detailer's development and makes him lose his pep. Yes, it surely is important when giving instructions to tell a man *what* you want done rather than *how* you want it done."

The Rights of Employers and Employees

"I am confident that we can minimize industrial controversy through a proper regard and recognition of the rights of both employers and employees," stated William Green, president of the American Federation of Labor at a recent meeting of the National Civic Federation. "The right of the employer to manage his industry, to control it and to receive a fair profit upon his investment should be maintained and recognized. The right of the employees to organize, to bargain collectively, to be represented in conference with employers, through their chosen representatives, is a right which should be readily accorded and completely recognized. A religious observance of these rights will do more to minimize industrial controversy than the application of any rule or formula.

"Supplementing the recognition of these simple rights must come understanding, co-operation and the manifestation of a mutuality of interest in the management and conduct of industry.

"Labor organizations have succeeded in many lines of industry in establishing such business relationships between employers and employees and have thus reduced the cause of industrial controversies. Organized labor is deeply interested in the proposal to eliminate industrial waste and has succeeded in bringing this about in a very large measure where it has had a proper opportunity to function. It seeks for the opportunity to do more effective work. It can, if given this opportunity, provide the machinery through which industrial controversies may be lessened and substantial help can be given in the task of eliminating waste and inefficiency."

Factors Concerning the Economies of Shopping Steam Locomotives

By L. F. Sillcox
Superintendent of Motive Power
Chicago, Milwaukee & St. Paul Railway Co.

The folly of continuing obsolete designs in service—Trend of unit costs since 1910—Effect of specific shopping policy on cost of repairs—Bearing of utilization of power on shopping policy

THE successful manufacturer must know the units of cost to produce his wares, for upon their application depend his profits. The universal adoption of more or less detailed cost accounts in both large and small establishments and the greater scrutiny given to them by owners and managers are real evidence of the value of such knowledge and the necessity therefor. Knowing that such information is successfully determined and applied in the commercial world, surely it can be as effectively established and employed in the matter of railroad-locomotive maintenance and be the basis of executive policy with a view toward assisting the average motive-power man in carrying out evident possibilities for economy and an effective procedure at least cost.

Economies are of two kinds: internal economies that can be carried out independently by the mechanical officer of his own motion, and the much greater economies that management, as a whole, can only make possible, based on current studies as to policies and possibilities. Perhaps one main reason why the justice of the principles above stated is not more readily conceded is to be found in the fact that it is oftentimes regarded as exceptional.

The Folly of Continuing Obsolete Designs in Service

A close study will often indicate the folly of spending large sums per unit to continue obsolete designs in service for long periods when the same amount would be more than sufficient, as an initial cash payment, for an up-to-date efficient design of greater capacity and less cost to operate or maintain. Assume that a passenger engine fifteen years old originally designed to handle a mine-car train is now required to carry fifteen cars on the same schedule, resulting in a heavy maintenance cost due to frame breakages, racking of machinery, valve motion and running gear. Then it becomes a question of not only maintenance but investment. If the original unit was 40,000 lb. tractive effort and was costing an average of $9,000 per year to maintain with a relatively low record of 3,000 miles per month, then it would seem proper to consider a new type of power, say, with 50,000 lb. tractive effort that would afford 5,000 miles of service per month and yet not cost more than $5,000 per year for maintenance, making a saving of approximately $4,000 per year maintenance cost and increasing the performance 66 per cent. This would justify making a change in power even though the original unit might have cost $30,000 and the new unit would cost $60,000. The original unit involved a maintenance cost of $9,000 per year plus a depreciation charge of $750, or a total of $9,750 as compared with an estimated maintenance cost of $5,000 per year for the new unit plus $1,500 depreciation charges or a total of $6,500, making a saving in the new unit of $3,250 per year, to say nothing of additional savings in fuel and transportation expenses. At 6 per cent this recovery would represent an investment of $54,000, or almost the cost of the new unit, but if this were done on a large scale then the amount of work would be performed with 66 per cent of the number of new units as compared with the number of old units, and thus the change would be justified.

Policy Used in Shopping Power a Central Factor

The same idea of promoting efficiency may be applied to the method employed in shopping locomotives, all of which resolves itself largely into a consideration of the program or the plan employed as best suited by any given administration. The range of possibilities in any given case may be easily determined from a study of practices obtaining on various systems, but, as a matter of fact, there are two extremes, with many variations between them. One may be termed the "high-frequency-shopping" and the other the "low-frequency-shopping" policy. The high-frequency-shopping policy is based on running locomotives through shops with an anticipated service of from twelve to fourteen months with a minimum of roundhouse attention. The low-frequency-shopping policy is based on running locomotives through shops with the idea of having a service of 24 months or more and with a greater degree of roundhouse attention to attain this length of service.

It appears that policy is largely governed by local conditions rather than local conditions being governed by policy. The Chicago, Milwaukee & St. Paul Railway Co. has had experience under both plans, and the general results obtained will be stated. Prior to 1921 a high frequency of back-shop repairs was employed, but after considerable study the plan was changed to a low frequency of repairs. The trend of unit costs, both prior and subsequent to 1921, is illus-

Abstracted from a paper presented at the Spring Meeting of the American Society of Mechanical Engineers, Milwaukee, Wis., May 18 to 21, 1925.

trated in Fig. 1. This chart is a graphic illustration of the results obtained under these two extremes of policy, affected, of course, by the price trend of labor and material in the meantime. The lines plotted represent three general groups, one indicating the growth and size of units maintained, another the various unit costs of maintenance, and a third the frequency of back-shop repairs. The growth of property maintained is represented by the dotted line *A*, which indicates the total tractive-effort pounds owned from 1910 by years to the end of 1924. This growth was not all in the nature of new equipment but represents power added by the acquisition of subsidiary and leased lines as well as some new equipment, and to that extent the growth line should not be confused with the rate at which new equipment

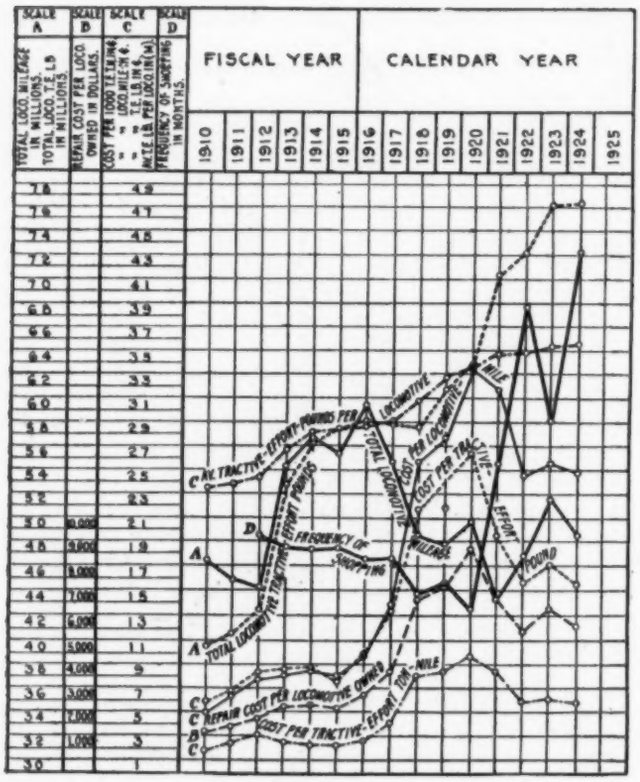


Fig. 1—Data on steam-locomotive and performance, C. M. & St. P. Ry., 1910-1924

might have eliminated obsolescence. This fact has a marked bearing on the cost of maintenance, as the total growth consisted of approximately as many of the smaller and older locomotives as of the acquisition of the larger and newer types. As to whether or not this extension of property was consistent with the growth of business naturally depends upon how the acquired lines may have increased the amount of business in relation to the amount of property. It is not desired to elaborate here upon the principles of the proper rate of growth of property, but merely to state that the method of computing the proper growth would be to determine the gross revenues per locomotive owned, affected somewhat by the characteristics of the lines added as to their ability to function on a high or low unit train-tonnage basis. Nevertheless the growth of property represents a serious problem in the matter of having back-shop development keep pace with it and of getting continuous use from power. Fig. 1 also shows the increase in the average size of locomotive expressed by the mean tractive-effort pounds per locomotive owned. The size of locomotives is an element in the unit cost of maintenance, and it will be noted that this figure increased from approximately 24,000 tractive-effort pounds per unit to 36,000 in 1924, or approximately 50 per cent. The chart is confined to steam locomotives only, electric locomotives being a separate and distinct problem. It is not possible to state whether the growth in locomotive ownership increased more or less than the revenues or the average train load, as these data are not available from the subsidiary and leased lines.

The feature in Fig. 1 that is deserving of closest study is the line *D* representing the frequency of back-shop repairs. This is arrived at by dividing the total yearly classified-repair output into the total owned throughout the year, which expresses the number of years between shoppings thus developed, and this of course varies according to the number of locomotives owned or used. This is based upon the classification of repairs instituted during federal control and is translated back to 1912. This classification runs as follows:

CLASS 1: New boiler or new back end. Flues new or reset. Tires turned or new. General repairs to machinery and tender.

CLASS 2: New firebox, or one or more shell courses, or roof sheet. Flues new or reset. Tires turned or new. General repairs to machinery and tender.

CLASS 3: Flues all new or reset. (Superheater flues may be excepted.) Necessary repairs to firebox and boiler. Tires turned or new. General repairs to machinery and tender.

CLASS 4: Flues part or full set. Light repairs to boiler or firebox. Tires turned or new. Necessary repairs to machinery and tender.

CLASS 5: Tires turned or new. Necessary repairs to boiler, machinery and tender, including one or more pairs of driving-wheel bearings refitted.

General repairs to machinery will include driving wheels removed, tires turned or changed, journals turned, if necessary, and all driving boxes and rods overhauled and bearings refitted, and other repairs for a full term of service.

Running repairs unclassified.

Suffix "A" to any class of repairs will indicate that the repairs are required on account of accident.

"B" will show the initial application of stoker.

"C" will indicate the initial application of superheater.

"D" will indicate the initial application of outside valve gear.

"E" will indicate locomotive was converted from compound to simple or from one type to another.

Mallet locomotives will be indicated by a star following application.

Locomotives receiving Class 1, 2, or 3 repairs must be put in condition to perform a full term of service in the district and class of service in which they are to be used.

Class 4 repairs not less than ½ term.

Class 5 repairs not less than ¼ term.

COST OF REPAIRS PER 1,000 TRACTIVE-EFFORT TON-MILES

The variation in the trend of line *D* is entirely dependent upon the allotment of labor and materials available for maintaining equipment. The shopping frequency increased gradually from 1912 to 1920, and during the latter year locomotives were going through at the rate of once every 14.28 months. In 1921 a committee was appointed to report upon the economics of shopping power, as a result of which it will be noted there was a radical change in the frequency of back-shop classes of repairs subsequent thereto. This study related is not offered as a criterion for the reason that other conditions often determine whether or not such a policy is applicable to any but a specific case. The frequency of shopping trend, expressed both in years and in months between shoppings is shown in Table I.

The change in plan necessarily brought about some modification in the distribution of machine tools and facilities in back shops and roundhouses. Great care had to be employed to avoid deferred maintenance under such a transition because of the high cost incident to overcoming deferred maintenance promptly and adequately were this condition to have obtained. The roundhouses were partially equipped to do the necessary machinery and running repair work and in some cases rather heavy boiler work so as to properly maintain the power for longer periods, some of the facilities being transferred from the back shops to the roundhouses. The back-shop forces were reduced in proportion.

Table I—The Frequency of Shopping Trend

Year	Years between shoppings	Months between shoppings
1920	1.19	14.28
1921	2.20	26.40
1922	3.30	39.60
1923	2.50	30.00
1924	3.70	44.40

The cost per locomotive-mile during the high-wage period of 1920 reached 34 cents when the shopping frequency was 14.28 months, but after the frequency of back shopping was reduced the cost steadily declined and in 1924 was less than 26 cents. This represents a reduction of approximately 24 per cent. The cost per tractive-effort pound was reduced from 27 cents in 1920 to 16.5 cents in 1924, or 39 per cent. The cost of repairs per locomotive owned was $9,300 in 1920 and $6,000 in 1924, or a reduction of 35 per cent. The cost per thousand tractive-effort ton-miles was reduced from 1.075 cents in 1920 to 0.676 cent in 1924 or 37 per cent. In the meantime the average size of locomotives increased 6 per cent. The method of measuring the cost of repairs per tractive-effort ton-mile was to take the tractive-effort pounds owned, reduce them to tons, multiply by the miles run in thousands, and divide this into the cost of repairs, account 308. (This unit should not be confused with ton-miles hauled; it is entirely independent of the rate of grade or curvature and is merely the force of one ton acting parallel with the rails and at the circumference of the drivers through a distance of one mile.)

This principle of shopping locomotives is in no sense special or peculiar. The plan was adopted for the C. M. & St. P. system because it appeared to be properly applicable. It is a matter of interest in this connection, however, to make a study of ten carriers where there is a wide range of policy, using the same units outlined above. The value of the units used cannot be considered as entirely intrinsic and for that reason the method employed should not be considered as absolute. The chart of Fig. 2 offered as a result of a study of various carriers, some having a high-frequency and some a low-frequency method. In plotting these data, scales were used merely to throw relative items together in order to indicate those which run in a certain ratio and those which run inversely. The horizontal scale is the average tractive-effort pounds per locomotive owned—to show the size maintained. These data are based on 12 months in 1924.

In the matter of performance the average miles per locomotive run per year is given by line *A*. This shows a difference in performance that does not follow relatively the variation in size of power, indicating many degrees in intensity of use, etc. The mileage ranges from 20,800 to 28,500 per locomotive per year. The carrier with the largest size of power made practically the same mileage per locomotive as the one with the smallest size of power shown on the chart, whereas those administrations with locomotives of a size ranging between the two extremes made less mileage per locomotive. This may be considered an element of performance and demand characteristics of the lines involved. In this case the highest mileage was 37 per cent greater than the lowest shown.

The cost per locomotive-mile as shown by line *B* is low for the carrier having the smallest size of power, being less than 17.5 cents, and is high for the one having the largest size of power, the upper range being a little less than 30 cents per locomotive-mile. The average size if power expressed in tractive-effort pounds was

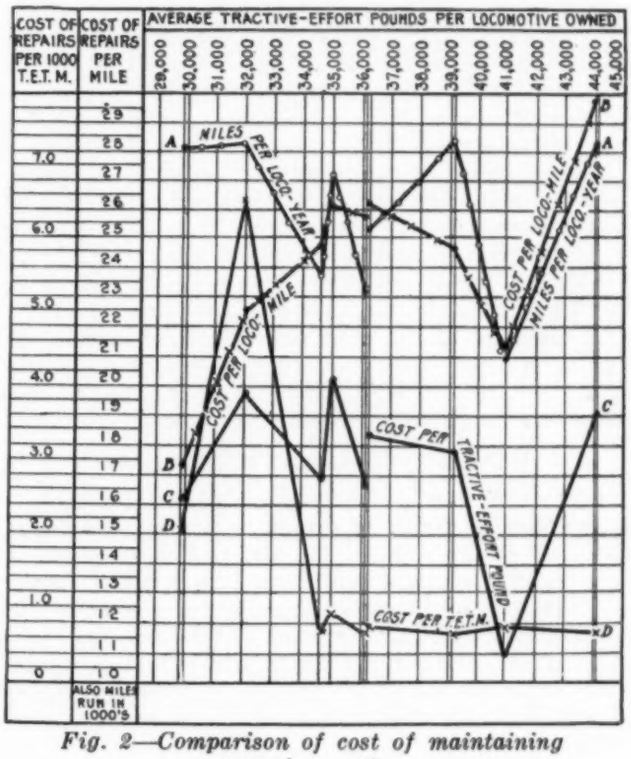


Fig. 2—Comparison of cost of maintaining steam locomotives

47 per cent greater in the largest average size as compared with the smallest average size, whereas the cost per mile was 71 per cent greater for the larger than the smaller power, so that it may be said that in this case the cost increased one and one-half times as the unit size of power increased. This figure is not in itself entirely significant.

These data indicate that as the average tractive-effort pounds owned increases, the cost of repairs per mile increases in a rather definite way; that the average miles per locomotive run and the average cost of repairs per tractive-effort pound have the same range characteristics; and that the average cost of repairs per thousand tractive-effort ton-miles varies somewhat inversely with the average tractive-effort pounds per unit owned, with intermediate fluctuations.

One way of measuring performance with shop output is to compile the locomotive-miles run since last shopping, setting this up in a cumulative way monthly and comparing it with the miles restored in classified repairs. The miles restored must necessarily be based on the assigned mileage, and the balance between miles

run out and restored cannot be accurately judged unless the assigned mileage is practically correct and consistent with actual performance. When the assigned mileage is set too high, then there will be more restoration of mileage reported by shop output than is actually run out; on the other hand, if the assigned mileage is too low, then the restoration is not in keeping with the run-out mileage. The experience of the C., M. & St. P. along this line has developed that the application of the assigned mileage for each type of power, regardless of its use, is not sufficiently specific, and such process when employed, needs revising by developing an assigned mileage for each type of power and for each division so that the local characteristics as to track, curvature, gradients, service, consequent tire and lateral wear, and boiler repairs can be considered as factors. Theoretically it is possible to group repairs into time cycles, but time is only one of the elements of shopping power, and as the frictional wear is mostly overcome in roundhouses the time element for shopping power resolves itself very largely into cycles based on necessity for heavy boiler repairs.

The regulation of frequency of repairs to locomotive parts is a matter of long-range study and the cycling of repairs cannot be followed specifically in all cases, although it has been the company's general policy to endeavor to follow a class No. 3 repair with a No. 4 or No. 5 and then with another No. 4 or No. 5 followed by a class No. 3, in other words, having two minor repairs between two major repairs; but this depends upon the nature of service performed and the severity as well as the rapidity with which mileage is run out.

A Study of Enginehouse Operation

A study of shop and roundhouse facilities cannot be summarized in terms of specific units to outline the direct effect upon policy and the results thereof. It involves the number of roundhouses per mile of track, the frequency of turning locomotives or the miles run between turnings. As a matter of interest, it may be stated that during the time in which the change in policy referred to was taking place, studies were made of enginehouse operation not only as to repairs made but as to the cost of turning power, frequency of turning, etc., with results shown in Table II. No comparison

Table II—Data on Enginehouse Operation

	Transportation Expense (Not Maintenance)		
	1922	1923	1924
Average turnings per month.	53,572	59,784	54,911
Average cost per month.....	$430,492	$384,969	$331,830
Average cost per engine turned	8.30	6.44	6.04
Average cost per engine-mile, cents	10.25	8.35	7.68
Average miles run between turnings	78	77	78

can be made with other carriers in this respect because the methods of counting engines turned, the accuracy of distributing charges, the nature of roundhouse facilities, etc., vary too greatly. The above figures are given to show that the trend in other expenses affected by locomotives was downward the same way as indicated in Fig. 1. The frequency of turning power decreases with the increase in average distance between roundhouses, and the average miles per engine turned will increase with the spread in distance between roundhouses. This involves the general study of utilization of power.

The utilization of power requires careful and detailed study because any variation must have a marked bearing upon shopping policy. It has been found, when comparing the performance of a greater number of carriers than used in plotting Fig. 2 that the tendency to run out locomotive-miles rapidly increases somewhat with the increase in size of power, and, as before stated, the rate at which mileage is run out is a determining factor in the proper frequency of classified repairs. There is a great variation in the mileage performance, and this reflects either good or poor power assignment and use, or a high or low density of traffic. Where the percentage of locomotives required for business is large in relation to the total ownership, where the monthly mileage is high, and where the hours of service per day are above the average of eight, this reflects a small reserve for detention in and awaiting shops, and the back-shop efficiency is then a more vital factor and the time consumed in making repairs is a greater element than where opposite conditions prevail. The average number of days out of service for the item of in and awaiting shop is not a matter of uniform record and therefore is not always available, but it is well to make mention here of the importance of having for this purpose a detailed knowledge of the number of days locomotives are out of service. It is possible to arrive at the average days of detention in the past so as to regulate the future by the use of the following formula:

Let

A = average number of locomotives in and awaiting shop per month;
B = total locomotives owned;
C = total days in the year and
D = frequency of shopping.

Then

$$\frac{A}{B} \times C = \text{Average number of days detention per locomotive per year}$$

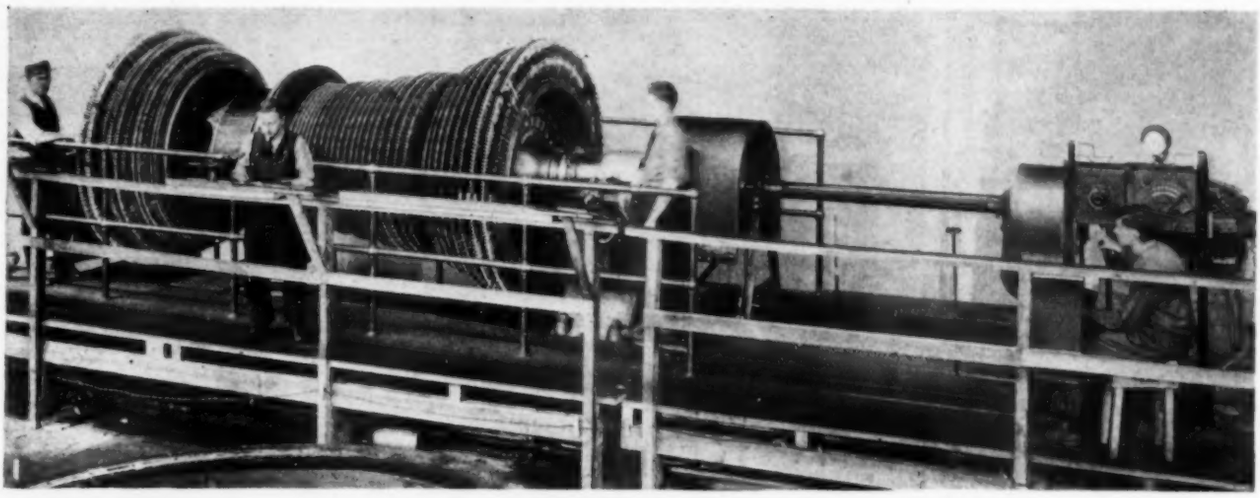
and

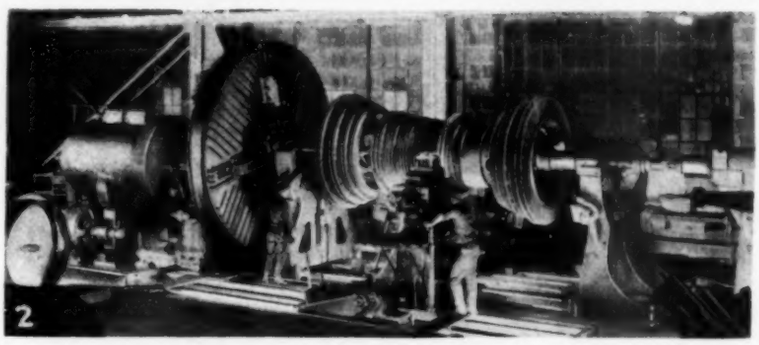
$$\frac{A}{B} \times C \times D = \text{Number of days detention per shopping.}$$

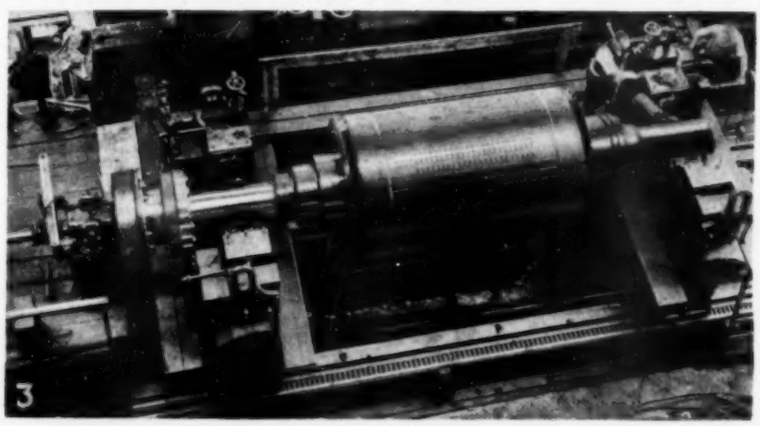
In cases where the percentage of power in service is low as compared with the total owned it is usually found that the hours of service per day are low or approximately six, which makes it possible to have a large waiting list and to turn locomotives less rapidly through the shops and still have ample protection for service. Intensive service requires a revision of the method of repairs, and in some cases calls for a higher standard of repairs than where more locomotives are used in the same service. The objective should be to get more locomotive-miles per month out of fewer active locomotives and more hours of service per day out of each locomotive; then other factors will naturally increase the gross ton-miles per train-hour.

Conclusion

One point of serious practical importance remains, namely, that the designated mechanical officer should place before his executive a practical and sound analysis of the requirements for the upkeep of motive power, shops, power plants, and tool equipment, and recommendations for expansion or rehabilitation to save against existing unit expense known to be out of keeping with the possibilities for best achievement. It is also desirable to view the problem from the standpoint of (1) Performance, (2) Cost, and (3) Progress.







Rotors and Cylinders for Turbine Generators

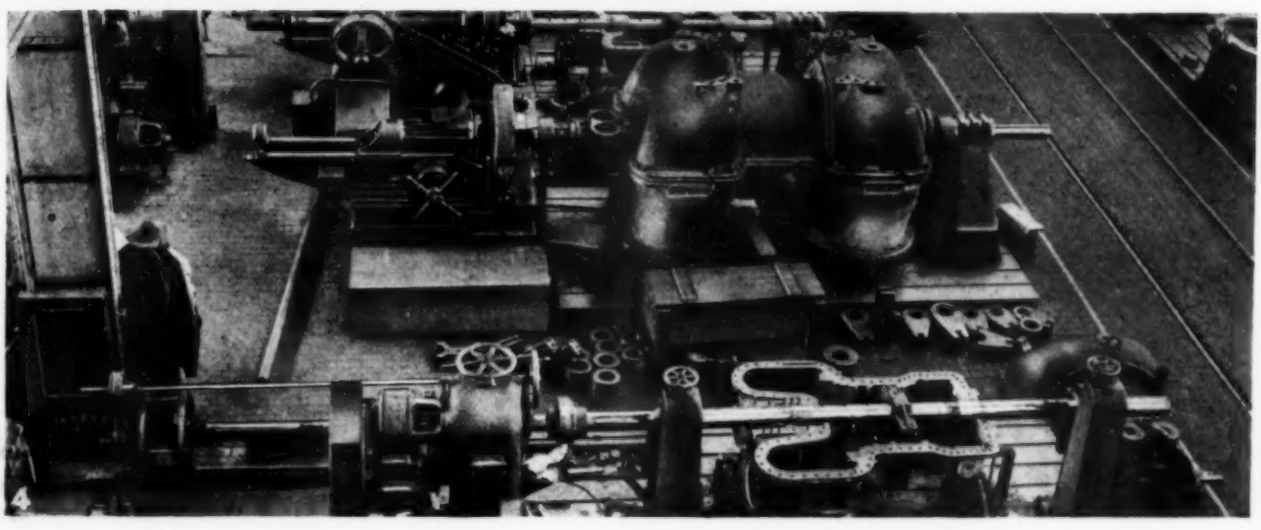
1—Balancing a 20,000-kw. turbine rotor

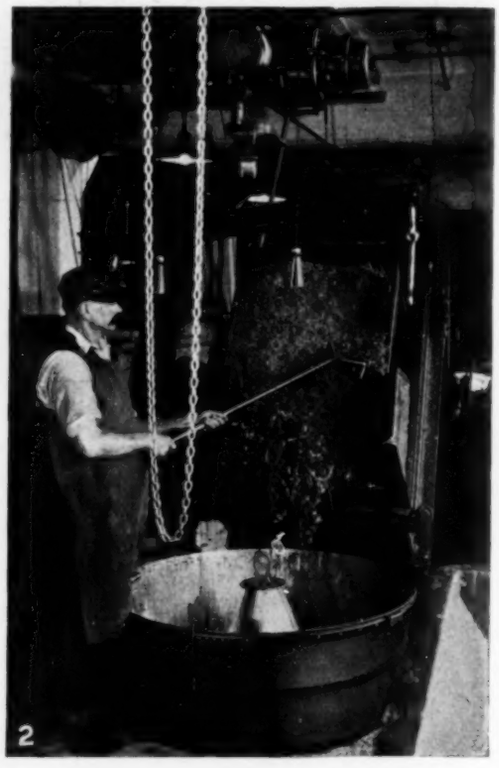
2—Finishing a rotor in a 160-in. lathe

3—Balancing a 30,000-kw. generator rotor

4—Boring small-turbine cylinders

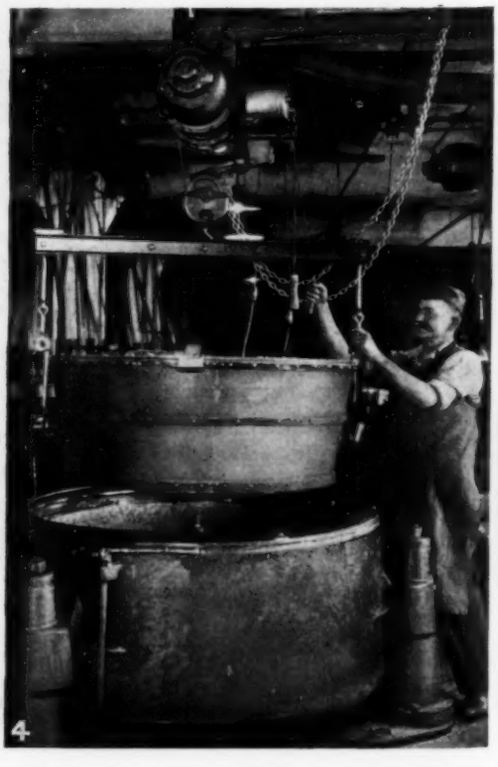
Photographs by courtesy of the Westinghouse Electric & Manufacturing Co.

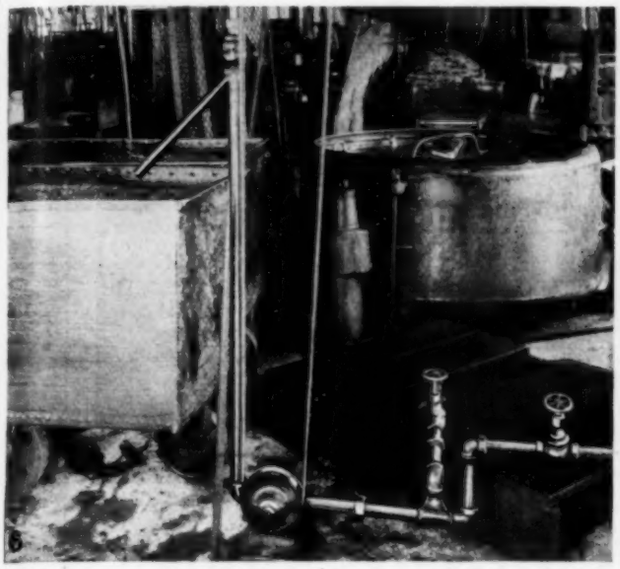


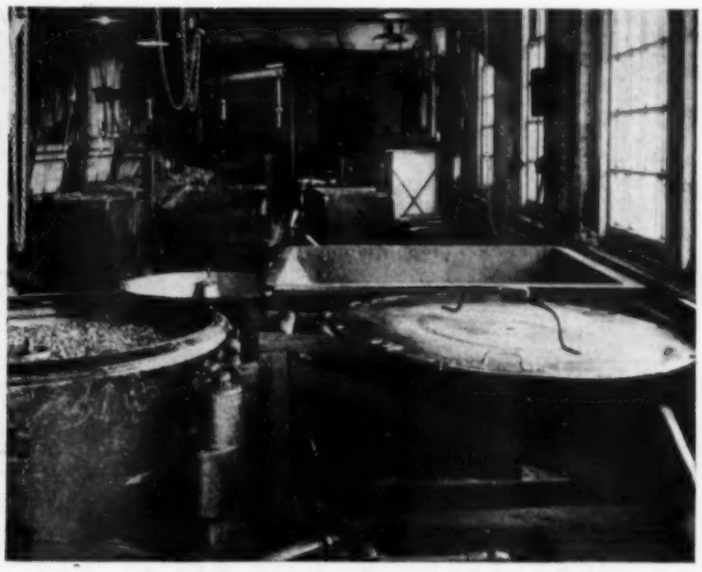


Oil Extraction and Chip Disposal

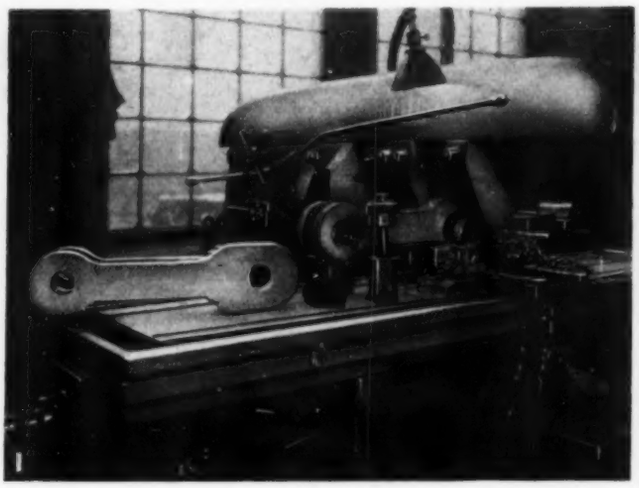
Photographs by courtesy of the Singer Manufacturing Co.







HOW oily chips are handled at the Elizabethport Works of the Singer Manufacturing Co. is shown in the accompanying illustrations. One man operates the equipment that takes care of a whole department. As will be evident from Fig. 1 the equipment includes two Tolhurst extractors with three chip containers, two ½-ton Shepard electric hoists, one mounted on a circular track, and a rig for dumping the chip trucks. The chips are dumped as illustrated in Fig. 2 and the load is balanced to reduce vibration as shown in Fig. 3. Fig. 4 shows the placing of the chip carrier in the extractor drum and Fig. 5 the fastening down of the cover. In Fig. 6 will be seen the oil pump and piping and the truck that receives the extracted oil. Fig. 7 shows the cover slid off on the roller table provided to eliminate lifting, and Fig. 8 the dumping of the dry chips down the chute into the car shown in Fig. 9. There are two of these installations, as is indicated by the double chute.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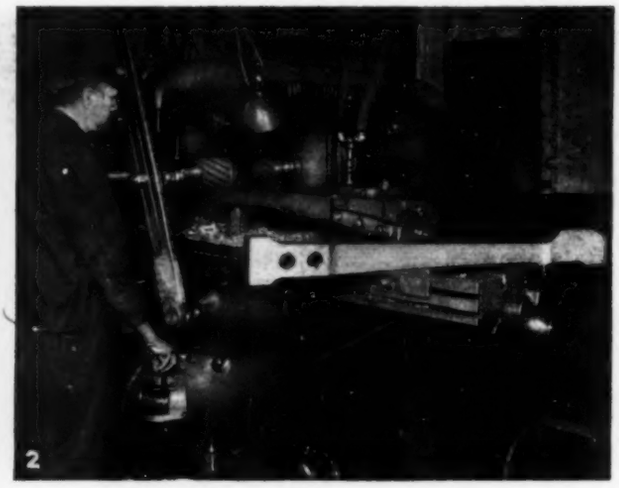
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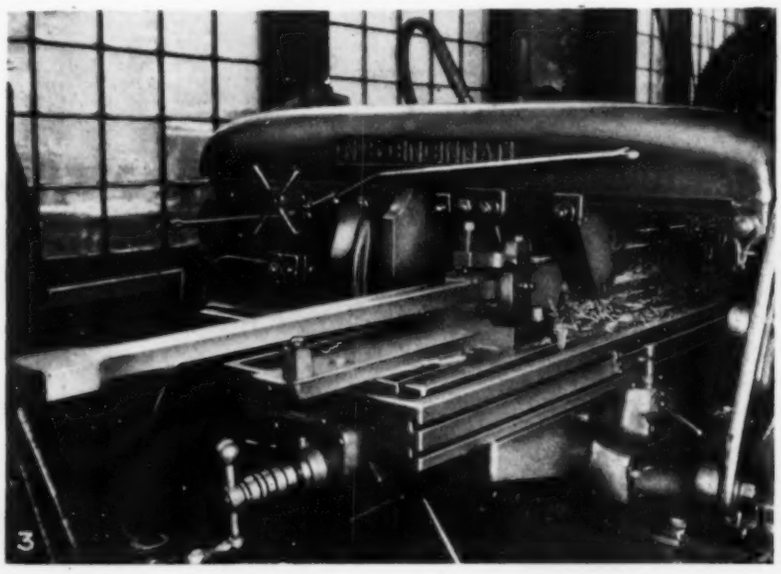
Milling Practice in Railroad Shops

Photographs by courtesy of the Cincinnati Milling Machine Co.

THE growth of interest in milling in railroad shops is clearly shown by such examples as those which can be seen in the accompanying illustrations. The first operation, shown in Fig. 1, is the milling of the long slot in the end of a locomotive spring hanger. A 2¼-in. hole is drilled and a helical milling cutter of the same diameter then cuts the slot at a feed of ¾ in. per min. A reverse cut brings the slot to size at a feed of 5⅜ in. per min. The gage is of sheet metal. Time, 10 min. floor to floor.

Two valve motion levers are being milled in Fig. 2. They are milled all over with two sets of fixtures. Power traverse is used both to move the table and to raise the knee, the latter moving at the rate of 30 in. per min. The operation shown takes 5 min. Markers on the table show the distance to be traveled. Another valve-motion lever, the radius rod this time, is seen being milled in Fig. 3. The yoke is first milled to depth, at ¾ in. per min., then the knee is raised and the feed reversed, milling the yoke to size. The quick-feed change enables the reverse cut to be taken at 5⅜ in. per min. The fixture shown handles radius and eccentric rods of all sizes used on this railroad. The time is 42 min. as against 3 hr. by the old method on the slotter. Note that the milling-cutter arbor is supported between the two brackets on the over arm in both Figs. 2 and 3. This method of support secures rigidity, increases production and lengthens the life of the cutters.

The simple, universal fixture shown in Fig. 4 holds various sizes of locomotive rods while the ends are being milled. The cutter is at work on the cross-head end which is solid, the cutter being entered through a drilled hole. The rod in this case is 6⅞ in. thick. The fixture allows room for a brace beneath to support the lower end of the milling cutter. A 1¾-in. helical cutter and a ⅜-in. feed are used for removing the block. The finishing cut has a feed of 3⅛ in. The time per rod is 3½ hours.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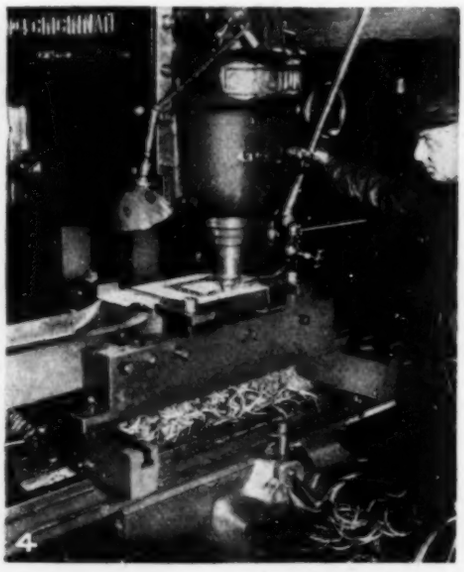

4

Development in the Design of Automotive and Railway Leaf Springs

By Joseph Kaye Wood
Consulting Engineer, New York City

Types of failures that occur in leaf-spring practice—Discussion of design defects—Calculation of band stresses—Various plan views and development of the "nozzle" plan—Design of springs to fit the plan

NOTWITHSTANDING the remarkable progress made in automotive engineering as a whole, the leaf-spring problem for that industry and the railway industry as well, is far from being solved. The large volume of business handled by many small concerns in replacing rear and front automobile springs is proof that many failures or breakages occur in an unquestionably severe service, difficult to estimate or calculate on a sound engineering basis. This service, as here discussed, does not include the transmitting of the driving torque through the rear springs, which is poor design from the spring standpoint, but does include the conditions that are involved when the springs are serving purely as shock-absorbing elements.

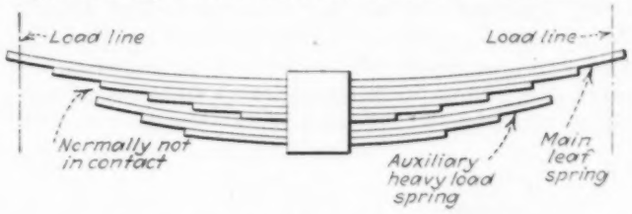


Fig. 1—A design including an auxiliary heavy-load spring

The following article gives, briefly, the results of an investigation of band stresses by the writer, in which a new development in leaf-spring design is brought out for the first time. This point consists in laying out the leaves in accordance with a new type of developed plan view which, for the want of a more appropriate name, is called the "nozzle" plan view. The purpose of this type of leaf spring, which is not any more expensive to manufacture than the usual type, is to remove the maximum bending stress from the section adjacent to the band, where it usually occurs, in order to compensate for the additional stresses at that section, due to the clamping pressure exerted by the band and also due to the center-pin hole. In the method of calculation employed, the clamping stress is computed from a formula, published for the first time, and the bending stress is computed from the regular flexure formula for leaf springs.

In order to appreciate the full significance of the development and to prevent the wrong use of the "nozzle" plan-view principle as an instrument of design in leaf springs, the writer first touches on the various types of failures that occur in leaf-spring practice and the methods, if any, employed in eliminating them. The method of calculating band stresses is then described, after which the "nozzle" type of spring design is described.

The proper design of leaf springs requires careful consideration of many factors. It requires more than the application of the usual leaf-spring formula and a knowledge of the physical properties of the spring material employed. Shocks, due to the combination of bad roads and high speeds, are the chief contributing causes of leaf-spring failures. Examination of leaf-spring tips that had fractured in service, and were picked up by the writer from the streets in New York City showed that such failures are characteristic of impact fatigue breaks.

Naturally automotive engineers are aware of this condition, and in recent years, solid rubber supports for the ends of the main leaf have been employed by the makers of a prominent heavy-duty truck and by a taxi-cab manufacturer. In pleasure vehicles, particularly of the more expensive kind, we find all types of impact absorbers, liquid and air dash pots, friction devices and combination friction and spring snubbers. The primary object, of course, is to provide personal comfort, although such a service requirement is one which the engineer should welcome, since in meeting it, he also eliminates or greatly reduces the shock stresses in the various parts of the automobile, particularly in the springs.

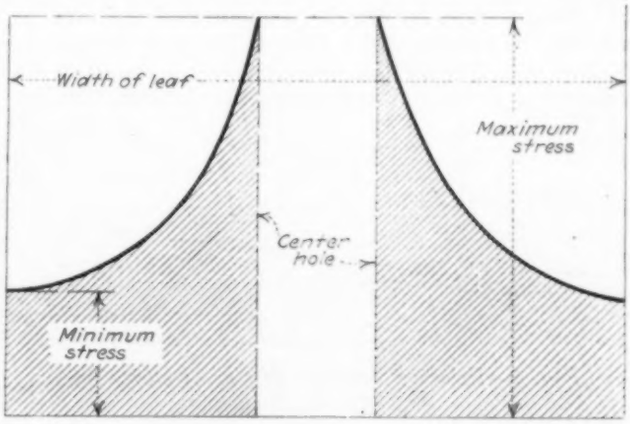


Fig. 2—Stresses due to hole in center of leaf (after Coker)

Paradoxical as it sounds, the main shock-absorbing elements, the front and rear leaf springs, must therefore be protected by auxiliary absorbing elements. To the technical and engineering minds, the verdict should therefore be that metallic leaf springs of the usual present-day design have not fulfilled the purpose for which they were originally laid out.

Two items which might be suggested for the essential

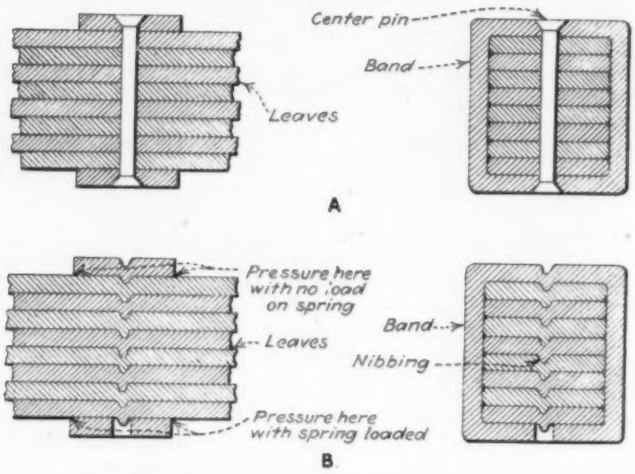


Fig. 3—Two designs of center band and spring

program of further research and development are as follows:

1—To determine a design of leaf spring which has the ideal type of load-deflection curve from the point of view of destroying oscillations and for self-adjustment to magnitude of shock.

2—To determine, in the present design of leaf springs, the best compromise between flexibility and magnitude of frictional component, since in obtaining more frictional area, the thickness of the leaves can be decreased to increase the flexibility. This in turn tends to decrease the unit force of friction, but whether the total frictional component is finally decreased or increased is a point to be determined by careful investigation.

In item 1, it is natural to suppose that the type of load-deflection curve which best destroys oscillations is the one that follows the same curve for damping on loading and on unloading but which is revolved 180 deg.

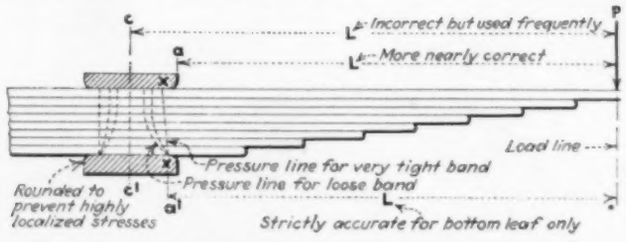


Fig. 4—Relation between degree of clamping and effective length

about a straight-line axis thus giving rise to what might be termed an exaggerated mechanical-hysteresis loop.

Both of the above items are worthy of research and it would repay automotive companies to apply a certain portion of the budget toward this end. The railway industry is not so vitally concerned with the individual leaf-spring problem as the service is less severe. It would, never-the-less, profit the railroads to look to their springs, particularly in the electric-locomotive class of service.

The usual spring failures may be divided into three general classes as follows:

A—Breaking or permanent flare of leaf tips due to sharp edges on the end of the shorter adjacent leaf or to overstressing of the tip, particularly when it is tapered in thickness.

B—Permanent ripple or reversed bend usually at the quarter lengths, caused by the changing of the camber from what is normally positive to negative, or vice versa, due to extreme service loads or improper design.

C—Breakages at modified or clamped portions of the spring due to increasing the unit stresses locally.

1—Slight reduction in area at sections where center or end-pin holes are made.

2—Unequal stress distribution at center or end-pin hole sections.

3—High clamping pressure at center band and low pressure at intermediate clips to insure a snug spring.

4—Sharp edges at point of contact between leaf and edge of band.

5—Combination of all these contributing causes at the center band.

The *A* class of failure is prevalent particularly in the case of the inexpensive automobile which is not usually equipped with auxiliary shock-absorbing devices. The precaution to take in eliminating localized stressing is to bevel, or round off, the end edges of the spring leaves thus giving the adjacent leaves a chance. Dressing, or tapering the thickness of the leaf tips in order

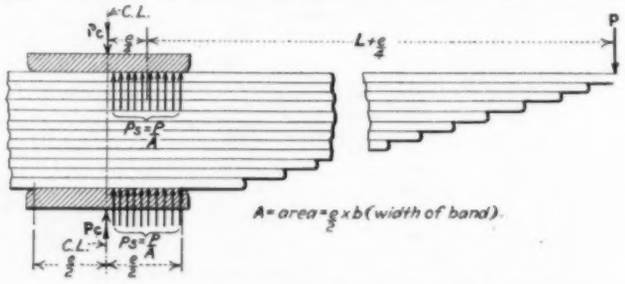


Fig. 5—Band stresses due to external load

to make the actual developed plan view of the entire spring conform more accurately to the ideal or theoretical view is liable to be overdone. On first overloading, when it is stressed beyond the elastic limit of the material, flared leaf tips result, that is tips which are not normally in contact with adjacent leaves.

Defect *B* is a common one often due to non-uniform stressing along the length of the spring. If designers would take the little extra time required to superimpose the actual developed plan view upon the ideal or theoretical one as pointed out by the writer on page 719, Vol. 61, of the *American Machinist*, more uniform stressing and less of spring failure would result.

When defect *B* is due solely to unusual service shocks, it is a question of doing two or three things. First the maximum deflection might be limited, which under the severe service load would make the spring "go solid" at the cost of comfort. Second, the safe working deflection might be increased by increasing the material index, which means using a higher quality of spring material. Third, by bringing a second auxiliary spring into play for the high loads. These methods are all used by the Fifth Avenue Coach Co. of New York City

in the design of its buss springs, which as shown in Fig. 1, consist of one main graduated leaf spring, placed directly over another auxiliary graduated leaf spring. As the abnormally large service load deflects the main spring, it comes in contact with the ends of the long leaf in the auxiliary spring. It should be especially noted that the latter spring does not serve as a rebound element.

Failures due to *C* are probably larger in number than

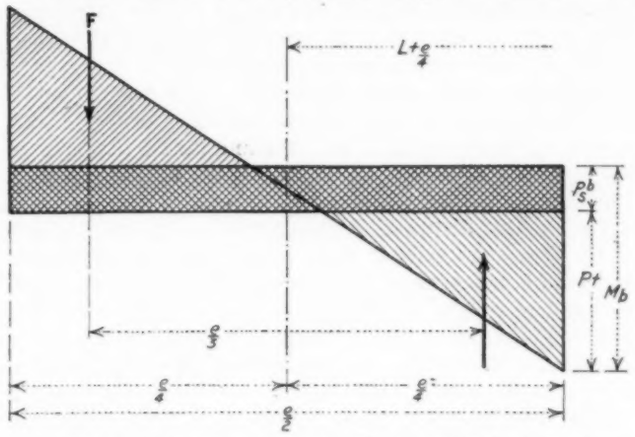


Fig. 6—Linear moments acting on half of band

any, due particularly to clamping conditions. A hole in the centers of the spring leaves does not greatly increase the total stress but it does produce high localized unit stresses. For this reason, the load-deflection rate and maximum safe deflection are very little affected, while the strength of the decreased section, particularly from the fatigue and impact standpoints, is greatly impaired.

The writer recalls, that in an investigation upon which he was consulted, many thousands of dollars had been spent in vainly attempting to increase the useful working deflection of a small flat spring, manufactured in hundred thousand lots, by varying the size of a hole near the clamped or maximum stress end. Needless to to say, the life of the spring was greatly shortened due to the hole. Had the theory of elasticity regarding boundary conditions been previously applied, it would have been found that the stresses were highly localized at the hole. Not long ago (1921), Professor Coker showed, by his photo-elastic method, that theory was generally correct in this respect, he having found that the stress gradient through the holed section Fig. 2, is as shown.

Clamping stresses produced in the section of the spring under the band, although not large as compared with the regular bending stresses, are important because the maximum bending stress occurs at that point. This, in addition to the weakening produced by the center-pin hole, is probably the cause of many failures. In some cases the use of a center pin as shown at *A* in Fig. 3 is dispensed with and replaced by "nibs" made in the plates themselves, as shown at *B*. Although the material at these nibs may, in certain cases, be overstrained because of the forming operation the section modulus offered to bending is slightly increased.

Center bands are usually shrunk on, so the plates are drawn together. Normally, at no load, there will be considerable pressure at the top edges of the band, while under load, the pressure will be at the bottom edges. In consequence of this, both top and bottom edges of the band should be rounded to a generous radius as shown in Fig. 4. Depending upon the amount of pressure exerted by the band, the probable region of pressure when the spring is under load, will be in accordance with the dotted lines in the sketch. The true effective length of the spring designated as *L* in the author's previous articles on the subject, would be taken from this line, wherever it may be, and since it is not a straight perpendicular line, the effective lengths for the different leaves vary. In usual practice, the effective lengths for the various leaves are all equal, being taken from the load line, to line *a-a'* in Fig. 4 and, too often, to the line *c-c'* erroneously.

Consider the clamping pressure of P_c and an area of A under the band, and that the maximum service load P for one half of the spring, subjects one half of the clamped portion of the leaves to an equal and opposite force at a distance of $L + \frac{e}{4}$ measured from either load line. This gives the following expression for unit pressure on the spring plates, Fig. 5:

$$P_s = \frac{P}{A} = \frac{2P}{eb} \qquad (1)$$

Consider next, that the sum of all the moments about a point is equal to zero. In Fig. 6, the couple $P\left(L + \frac{e}{4}\right)$ is resisted by an equivalent couple $\frac{Fe}{3}$ therefore,

$$P\left(L + \frac{e}{4}\right) = \frac{Fe}{3} \qquad (2)$$

or

$$F = \frac{3P\left(L + \frac{e}{2}\right)}{e} \qquad (3)$$

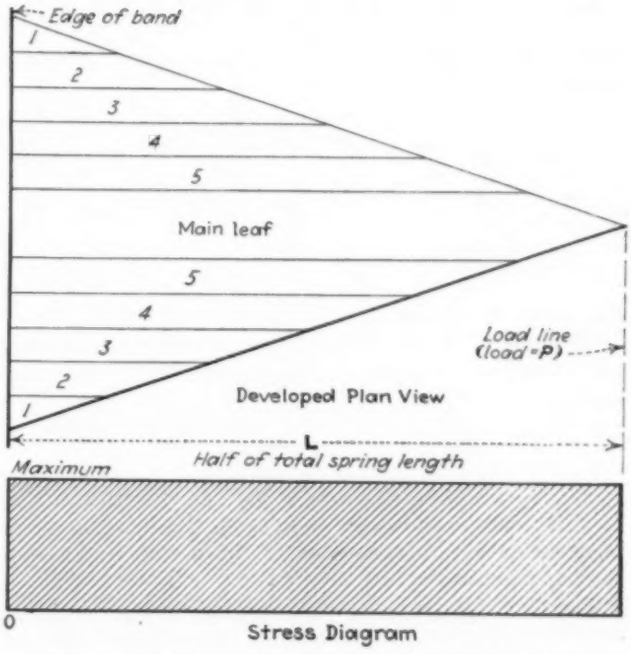


Fig. 7—Ideal or triangular developed plan view

where F is a force equal to the area of the triangle whose base is $\frac{e}{4}$ and height is the unit pressure P_t per linear width of band. We then have,

$$P_t = \frac{8F}{e} = \frac{24P\left(L + \frac{e}{4}\right)}{e^2} \qquad (4)$$

The unit pressure M on the spring leaves, due to the total spring load $2P$ from (1) and (4) is as follows:

$$M = 2\left(P_s + \frac{P_t}{b}\right) = \frac{4P}{eb} + \frac{48P\left(L + \frac{e}{4}\right)}{be^2} \qquad (5)$$

The unit compressive force M_t due to both clamping and the external spring load is as follows, where P_c

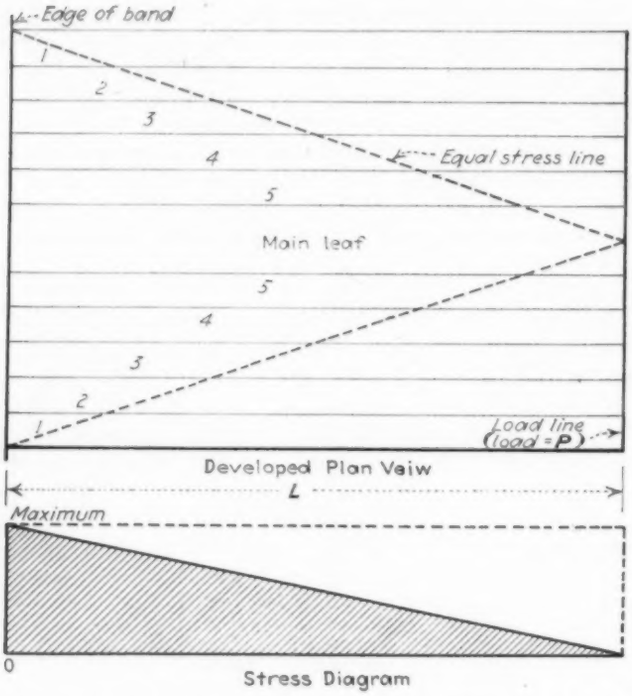


Fig. 8—Developed plan view with all leaves full length

is the unit stress on the spring leaves due to shrinking the band:

$$M_t = M + P_c = \frac{4P}{eb} + \frac{48P\left(L + \frac{e}{4}\right)}{e^2b} + \frac{P_c}{eb}$$

or

$$= \frac{4eP + 48PL + 12eP + P_ce}{e^2b}$$

$$= \frac{16Pe + 48PL + P_ce}{e^2b} \qquad (6)$$

Assuming at random a value of $P = 1{,}500$ lb., $Pa = 2{,}000$ lb., $L = 36$ in., $b = 4$ in. we obtain the following unit compressive stress on the spring leaves under the band

$$M_t = \frac{(16\times1.500\times4) + (48\times1{,}500\times20) + (2{,}000\times4)}{16\times4}$$

$$= 24{,}000 \text{ lb. per square inch.}$$

To this must be added the regular spring-bending stress in order to obtain anywhere in the dotted line x-x' in Fig. 4, the total stress.

These calculations are of course only suggestive since assumptions are made without previous tests. For example, it probably is not always true that the line x-x' is so nearly straight and that the band is so generously designed as to be considered rigid. The indications are that the band stresses may be seriously high, particularly if the regular bending stresses are also high. The seriousness of the band stresses is greater if the top and bottom edges of the band are sharp and if a center pin is employed. If, in addition to all these defects, we consider that the spring is not provided with rebound leaves and properly-fitted clips which serve both to buffet rebounds and prevent side play of the leaves, or any kind of auxiliary shock absorbers, we must surely look for trouble.

A New Development in Leaf Springs

In view of the possibility of a spring failure arising from high band stresses, it occurred to the writer that it would improve leaf-spring design if the maximum or equal bending stresses were removed from the vicinity of the band. Fig. 7 shows half of the developed plan view of the ideal or equal-stress spring which, when cut up into leaves and fabricated, gives a uniformly graduated system of leaves with pointed ends. The stress diagram for this theoretical spring is also shown. The developed plan view and stress diagram of the opposite to the ideal spring, Fig. 8, which, when cup up into leaves would give the unusual spring having equal leaf lengths. A plan view and stress diagram more nearly in accord with actual leaf-spring design and which is intermediate between those of Figs. 7 and 8 is shown in Fig. 9. Usual design formulae cover the ideal case shown in Fig. 7, but in previous issues of the *American Machinist*, the author has developed a formula for the case shown in Fig. 9. When cut up into leaves, the resulting fabrication may have only one full leaf, cut off or truncated at the extreme end or it may have more than one of these leaves, depending upon the width chosen. All shorter leaves, in either case would be uniformly graduated.

Fig. 10 shows a developed plan view and the corresponding stress diagram of an actual leaf spring. In this case as well as in the more theoretical cases described above, the stress in any section, assuming constant thickness, is nowhere greater than at the edge of the band and, in most cases, it is less. The question

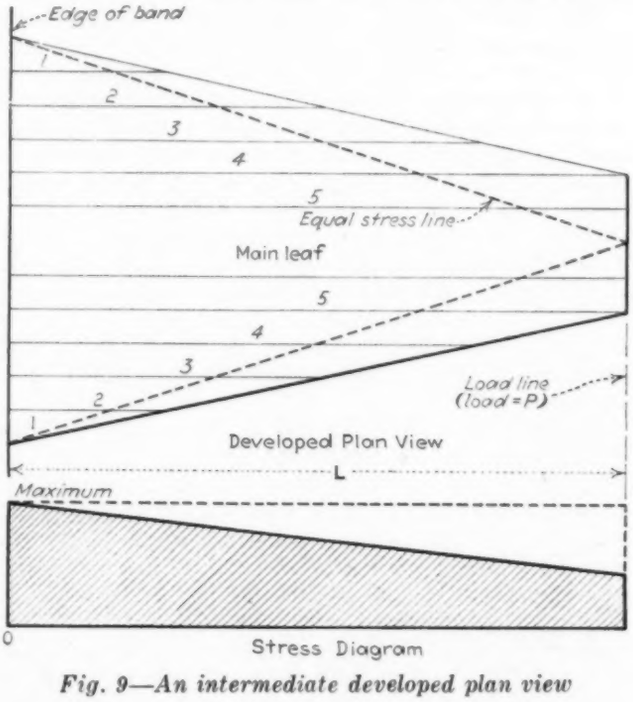


Fig. 9—An intermediate developed plan view

arises therefore as to what type of developed plan view will give lower stresses in sections removed from the band.

Referring to Fig. 11, the areas of sections that terminate in the triangular or theoretical plan view will divide the bending moments on those sections so as to

give a constant unit stress. Areas of sections that terminate in the trapzoidal or truncated triangular plan view divide their corresponding bending moments to give a uniformly decreasing unit stress from a maximum at the band, to a minimum positive value at the tip. For two given sections, one in the triangular plan view at *a-a'*, Fig. 10, and the other in the truncated plan

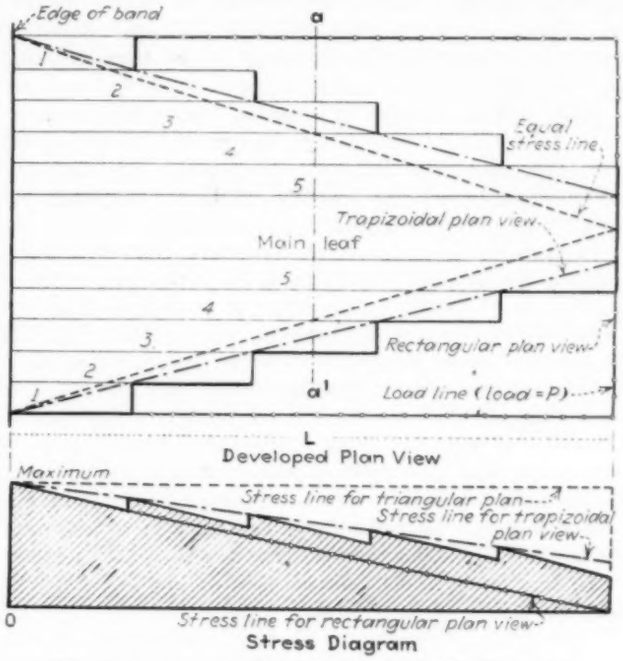


Fig. 10—An actual-spring developed plan view

view at *a-a'*, Fig. 11, and both under an equal bending moment, or under equal lengths, the unit stress in the former will be greater because the area is less providing the loads are equal.

In the extreme case of the rectangular plan view, where the area is constant instead of decreasing uniformly from the band to the free end, the slope of the stress gradient is a maximum, while in the absurd case of an inverted trapzoidal plan view, the stress gradient is no longer a straight line, but one curved inward toward the center line of the plan view. In no case considered, including the actual plan view has the unit stress in any section been shown to be greater than at the band, or even equal to it to any extent.

In general, we can say that in any plan view, whose sections terminate on or beyond an isosceles triangle whose base is the width of the plan view at the end, the maximum unit stress will be at the band, although in certain cases it may also be at other sections. The natural question is, therefore, in what manner can the maximum stress be removed from the dangerous section at the band?

Consider the plan view *ABCD* in Fig. 11 whose "nozzle"-shaped sides give rise to sections that terminate *within* the triangular plan view. The section at *Y-Y'* for the latter, gives a unit stress equal to that given by the section at the band for either the triangular or the "nozzle" plan views. But since the section at *Y-Y'* for the "nozzle" plan view is within the triangular outline, the corresponding stress is less than at the band. The stress diagram for this view, also given in Fig. 11, shows very plainly how the maximum stress instead of being at the band is at *Y-Y'*. By manipulating the curvatures of the sides, the ratio of the unit stress at section *Y-Y'* to that at the band may be made to compensate for the additional clamping stresses induced at the band.

For example, assume that the clamping stress at the band section computed by formula (6) is 10 per cent of the regular bending stress at that section. Then the width at *Y-Y'* for the "nozzle" spring should be made 10 per cent shorter than the width of the triangular spring at *Y-Y'*. The regular formula for computing the bending stress, was given by the author in previous articles on leaf springs appearing in the *American Machinist* and is as follows:

$$S = \frac{6PL}{Bt^2} \qquad (7)$$

where S is the unit stress, P the load, L the length to the given section whose width is B; t is the constant thickness.

Another characteristic of the "nozzle" plan view is that the location of the maximum stress section may be set as desired by simply manipulating the shape of the curved sides, without necessarily affecting the value of the maximum stress. This control is desirable in the face of other considerations which will be mentioned later.

It is only another step to show the particular and far reaching advantage in the application of the principle

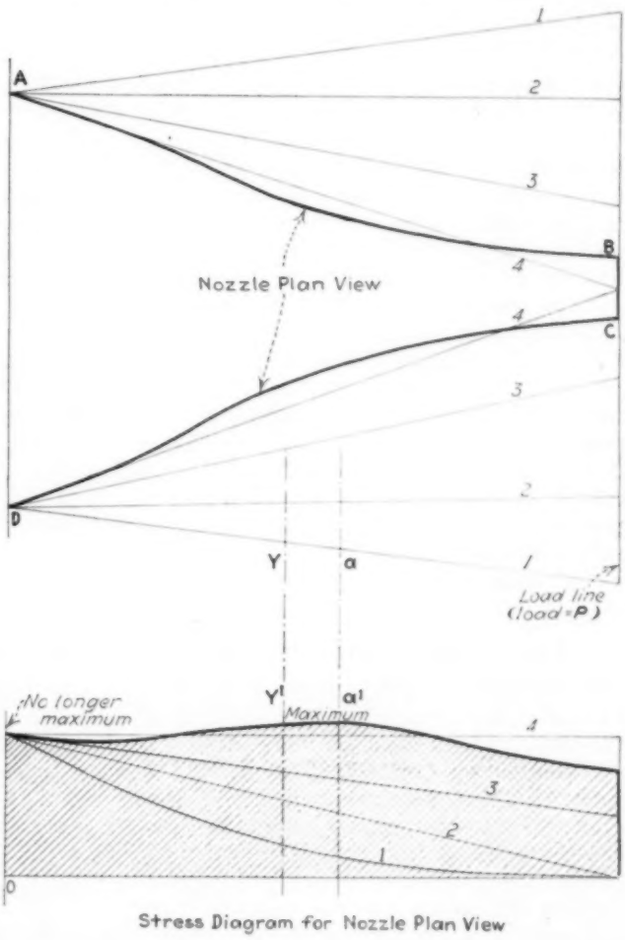


Fig. 11—Stress diagram and "nozzle" plan view

to the actual leaf spring. The fitting of spring leaves with squared or tapered ends to a typical "nozzle" plan view is shown in Fig. 12, in which there are a pair of leaves of equal length. The fabrication of these leaves

would result in the type of leaf as shown in Fig. 13, which type of spring does not involve any added expense in either manufacture or material.

Although it is of great advantage to remove the maximum bending stress from the section at the band to some other more remote section, the writer advises

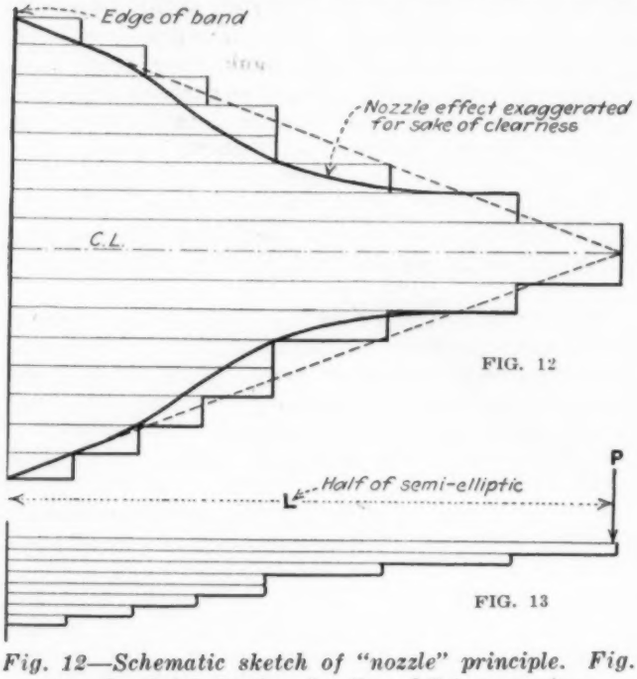


Fig. 12—Schematic sketch of "nozzle" principle. Fig. 13—Leaf fabrication for "nozzle"-type spring

caution in the use of this principle. The maximum-stress section of a nozzle spring should not be placed at a point where reverse bends are liable to occur or where additional clip or rebound spring stresses may also exist. All important factors entering into the problem should be given their due weight and the principle applied accordingly.

Since this principle and the method of computing the clamping stresses under the band are a new development in the theoretical design of leaf springs, the writer would like to see it developed further on a practical basis. It is of course possible to present here only a small part of his investigations covering this new development as a complete study of the deflection and oscillation characteristics, along with accurate stress computation, would take many pages.

Aeronautical Safety Code Revised

A revision of the American Aeronautical Safety Code was finally acted upon at a meeting of the sectional committee held at the Bureau of Standards, Washington, on April 23. The meeting was conducted by H. M. Crane, past president of the S.A.E.

Every important organization interested in aircraft is represented on the committee so that the report may be considered as the consensus of opinion of the entire aircraft industry.

Nearly all of the changes were of minor importance, dealing with the construction of wooden ribs, identification of pipe lines and other construction details. One change dealt with the equipment for radio signalling, and another specified that pilots of aircraft carrying passengers should have had adequate experience with the particular type of craft used.

A Short Cut for Stores Accounting

By C. E. Bliven

The well-regulated factory storeroom will always require some form of requisition before issuing any material. After the material called for has been delivered, the storekeeper notes on the requisition the amount of material actually passed out in terms of pieces, weight or measure, and the requisition is then passed on to the stores-accounting department for routine handling by the clerks. The more complex the system, the greater will be the cost of entering each single item.

In production work, where the quantities called for are large, the ratio between the value of the material requisitioned and the clerical cost of handling the requisition is very small.

In plant maintenance work, however, it is often necessary to requisition a single article, the money value of which may be only a few cents or even less than one cent. In these cases the cost of accounting for the material is many times the value of the material itself.

Most of the materials which fall within the scope of this plan are received at the storeroom in commercial packages containing from twenty-five to a gross of pieces. Under the modified plan, certain general maintenance accounts are established which cover work and material that could be charged against a certain department, yet because of the fact that the repairs are necessary for the continued operation of all the departments, they are made a general charge.

On certain commercial package goods and other items, the storekeeper writes a requisition for a full package or for a predetermined number of pieces, and makes the charge against the proper account. This material is then considered as "supply stock." The store-keeper then passes his requisition to the stores-accounting department for routine handling. One entry, therefore, covers from twenty-five pieces to a full gross and the cost of entering several requisitions for small quantities of the article is saved. When a requisition for less than a full commercial package of the article is presented to the storekeeper, he delivers the material from his "supply stock" and then destroys the requisition.

Should the requisition call for one or more full packages and a broken package the store-keeper supplies the proper number of unbroken packages and makes up the balance from his "supply stock." Then he notes on the requisition only the actual number of unbroken packages which he delivered and sends it to the stores-accounting department for entry. The stock clerk, of course, will enter only the number noted by the storekeeper since the broken lot has been already accounted for on a previous requisition.

In certain cases, where the material is received in bulk, the store-keeper charges out twenty-five or more pieces, puts them in his "supply stock" and sends through his requisition in the regular manner. The disadvantages of the method as pointed out by the accountants, are that the material is not charged against the department particularly benefitted, the actual, day by day, inventory does not agree with the records and by reason of this disagreement the stock on hand may become excessive.

The advantages of the method are in reduced labor cost for bookkeeping, in no material being withdrawn from the store room without a proper requisition and it being unnecessary to requisition more than is needed.

Successful Manufacturing Methods in America

By G. Schlesinger
Charlottenburg, Germany

Abstract of paper presented at a meeting of the German Machine Tool Manufacturers Association—Design and Manufacture of Standard Machine Tools—Use of Machine Tools

THE centers of the American machine tool industry are in the states of New England and Ohio. The greatest use of these machines is made in Detroit, the great American automobile center. The writer studied the machine tool industry in thirty large factories and at the two machine tool exhibitions at New Haven, Conn., and Boston, Mass., in September, 1924, where about 150 American firms were represented. The uses to which these machines were put had been studied in fourteen machine shops where automobiles, locomotives, electrical and agricultural machines were manufactured. A short account of the writer's experience is given here.

The tendency is to strengthen the gearing, the frame and the vees. Mold casting is much used.

In finishing machine beds the temperature rise is avoided by the best firms by substituting a planing operation for milling. Even the Cincinnati Milling Machine Co. considers the necessary loss of time through seasoning as more important than the possibie cheapening of the product by milling. Hard spots encountered occasionally will spoil the work if milling cutters are used, but with planing this danger is much reduced.

Steel gears, generally annealed but sometimes also hardened and ground, are the rule; they allow the designer either to increase the load or to have lighter gears. The tendency to have direct motor drives is still prevailing, although step pulleys are also used as they are cheaper and better suited to great speeds (aluminum, light metal).

The improvements in design aim generally at easier operation. All levers are in easy reach in front of the operator. The sliding gear in the gear box has nearly displaced the tumbler.

As an example of unnecessary complication due probably to a sort of fad, with resulting higher prices, the elaborate speed-box and feed gear arrangements of certain tool-room lathes are given.

The standard of quality for machine tools set by leading American manufacturers is high. The best machinery and limit gages are used in production; this is true of the oldest firms as well as of the newer ones.

Reliable firms manufacturing small, medium and relatively large machines, finish the guiding surface by hand-scraping although with planing alone a high degree of accuracy could be attained. The writer has not seen the grinding of guiding surfaces by large surface grinders although great interest is shown in this respect. In special cases surfaces as large as 17x50 ft. for planer tables could be planed true without the need of hand-scraping. In certain works all the machines needed for the production of each separate part are exclusively used for this purpose. This seems to be an unwarranted outlay of invested capital as stock orders amounting to from 20–50 machines are seldom seen, even in cases of extremely specialized output.

IT IS a salutary experience, on occasions, to hear what other people really think of you. The machine tool building and using industries should therefore listen with attention to what an eminent German engineer has to say about their products and their practice. Dr. Schlesinger spent some months last year in the United States and his report of his trip to the German Machine Tool Builders' Association is enlightening. For obvious reasons most of the names of companies have been omitted from this abstract. They are given in full in his original report which was published in "Werkstattstechnik" in connection with the Leipzig Spring Fair.

The tendency of automatic machinery is in the multiple-spindle direction.

In the case of single-purpose machines there seems to be no limit to the ingenuity and resourcefulness of the designers. It certainly pays to build the utmost in machine efficiency as large orders for successful machines continually prove. Multiple-spindle drilling machines for special automobile parts, vertical surface grinders with automatic feed and demagnetization of ball-bearing races are only two examples out of a large number of such machines.

The lathe with multiple tooling has won an enviable position. The cutters are made of various grades of tool steel to allow for the varying cutting-speeds required. Pneumatic devices are also much employed. Stellite tools are used with great advantage as they permit very high speeds.

Grinding is done in two stages on different machines. In the first stage, rough and quick grinding is done, the finishing work taking place on grinding machines of the most refined accuracy. This allows economical mass production and is the practice in many American factories as, for example, in the automobile works of Ford, Chevrolet, Buick and Dodge.

In gear-cutting machines accuracy of 0.001 in. and sometimes higher is guaranteed. For grinding gear teeth of all shapes special grinding machines exist. With polishing machines the case is similar to that of the grinding machines.

The writer was greatly impressed by the design, execution and price of machine tools manufactured in the works visited by him. Americans are accustomed to pay good prices for good machinery. With them the first cost of equipment plays only a secondary rôle in mass production. Those firms who neglect the quality of their products are generally leading a miserable existence and are bound to disappear in the long run.

Machine Tool Factories

The equipment, gages, tools and other devices in machine tool shops were found to be in most cases of surprisingly high quality. The whole organization for interchangeable mass production is so standardized in such firms as Brown & Sharpe, Potter & Johnston, Le Blond, Gray, Cincinnati Milling, Cincinnati-Bickford, Lodge & Shipley, Jones & Lamson, Gleason, Geometric Tool, and others, that even in cases of prevailing small orders, the daily per capita production is remarkably high.

The impulse for this extraordinary production was given by the abnormal post-war inflation which occasioned later very painful readjustment.

The lion's share of the production is in the large factories, but this is due primarily to their splendid organization. Single factories, as, for example, Jones & Lamson, have adopted the progressive assembly method although they produce daily not more than 5–6 machines. This factory is a good example of production and organization methods that could be considered as relatively applicable with good results in Germany. It is interesting to note that there the work is done not by processes (planing, milling, drilling, etc.) but by units (bed, gearing, carriage, etc.), and this with a lesser number of machines and less floor space. The routing is established two months ahead.

Types of Buildings

The new shops are generally of the "hall and galleries" type. They are in the suburbs of cities where the price of land is lower. Good examples of this type are afforded by the new shops of Le Blond, Cincinnati Milling, Lodge & Shipley, Bullard, Monarch, etc. Other shops as, for example, Brown & Sharpe, are of the "high-building" type. This does not influence the quality of the product and the older factories have in many cases not changed their buildings although their equipment is very much up to date.

At the time of my visit (Sept. 1 to Nov. 7) the business conditions in the machine tool industry were not good and factories were probably working at about 33 per cent of capacity only. It is interesting to note that in America 15,000 automobiles can be manufactured daily, and of these 13,000 cars can be made in fifteen Detroit factories alone. This means that Detroit can build in three days more cars than all the ninety automobile factories of Germany built together in 1924.

For the last few years standardization of the basic elements of machine tools has been recognized as a means toward the increase of national production. The standardization mechanism is along broad lines the same in America as in Germany. There is a national standardizing committee co-ordinating the work of a great number of sectional committees in which the most experienced specialists and other interested and competent parties are establishing industrial and engineering standards.

Among others the following standards are now being established: Screw threads; tolerances and allowances for machined fits in interchangeable manufacture; small tools and machine tool elements; gears; shafting; pins and washers; and various safety codes, as for example, abrasive wheels; power presses and foot and hand presses; metal-cutting machine tools; power transmission apparatus; foundry work; compressed air machinery, and many others.

In the use of machine tools American industry is a good example to be followed as nearly as possible in Germany. What the writer saw in Detroit, Chicago, Lynn, Schenectady, Philadelphia, Pittsburgh and other big industrial centers is really overpowering. He was much pleased with the way in which he was furnished with all information available of interest to him. In some cases this was original drawings, results of experience of much value, special installations, and other valuable data.

Use of Machine Tools

The tendency of American industry is to eliminate the workman as much as possible and to increase production through improved machinery. The automobile industry and the increasing use of agricultural machines are good examples to be cited in this respect.

It is interesting to note that the increase in railroad construction has been very slow during the last decade. At the same time automotive transportation has increased enormously. The important rôle played by Ford in this respect cannot be overemphasized.

If we compare the weight per seat of a small automobile (about 360 lb. per seat) or of an autobus of simple model (about 280 lb. per seat) with that of a normal railway car (about 1,900 lb. per seat) or with that of a Pullman car (about 5,900 lb. per seat), we can easily understand the importance of automotive transportation.

Nearly one-third of the steel consumption in America is due to the needs of the automotive industry and this naturally stimulates machine-tool construction.

In farming, the increased use of agricultural machines has steadily increased production per workman. At the same time the smaller farms are steadily giving way to larger ones. A similar tendency exists in the automotive industry where the smaller factories give way to larger ones.

Die Casting and Other Processes

Die casting is now extensively used in America and gives very satisfactory results as to production and accuracy. The Doehler Die-Casting Co. produces machine parts weighing from 9 to 16 lb. The alloys used have as basic metals, zinc, aluminum, tin, lead and copper in various combinations. The degree of accuracy obtained is remarkable.

The swaging process is also used but is less accurate and for higher precision a coining process has been developed. The latter is used for example by the Hudson Motor Car Co. of Detroit to great advantage.

The fundamental principle governing the conveyor installations in factories is not to allow the productive work to stop through unnecessary delays occasioned by loss of time in waiting or in hunting around. This occasions the necessity of the timely inspection of each step of production of "flying" inspectors in those cases where mass production is not large enough to warrant the inspection of the moving product by "stationary" inspectors as for example in Ford's plants.

Kinds of Conveyors Seen

According to the volume of production, the type of conveyors is different. A chain type of conveyor is used by the Ford Motor Co. in the foundry at River Rouge. The same company uses at Detroit, Mich., conveyors of this type for the transportation of crankshafts and finished cars and the belt type of conveyor for motor cylinders.

Conveying by rollers, moving horizontally or along an ascending spiral is done at the National Cash Register Co. in Dayton, Ohio, in combination with elevators or by gravity between machines. All kinds of trucks are used in the factories of Buick, International Harvester, Jones & Lamson, and other companies.

To give an idea of the speed of production we can mention the fact that at Ford's factory a piece of raw material arriving early in the morning of a certain day will be incorporated in the car and leave the factory within 36 hr. This means that Ford revolves his capital once every two days or 150 times a year. What that means can be understood if compared with the capital turn-over in the machine tool industry where from one and a half to two turn-overs per year is considered as satisfactory. In no other country than America have such amazing records of production in such an uninterrupted way been approached at all.

Wages

The wages in America are very high and this refers not only to hour-rates but also to weekly wages, notwithstanding the fact that highly skilled workmen often do not work the whole week through. The highest wages are for brick-layers and iron construction workers, $18 per day, about $100 per week, although these are season workers. Hammersmiths in locomotive works, for example, receive the same wages.

The living expenses of the American worker are 2–2½ times higher than in Germany, but his wages are about four times higher if lower averages are taken. The difference is still more unfavorable for Germany if the higher wages are compared.

Safety devices are in America at least as good if not better than in Germany and this without the necessity of law enforcement.

Apprenticeship

The question of apprenticeship seems to be in a developing state. Until recently the immigration of skilled European labor has probably contributed to make the apprenticeship question a less important one. Important manufacturers admitted this to be true, and that now, with restricted immigration, more attention will have to be paid to a systematic apprenticeship. Only a few large and well-managed companies, as, for example, Brown & Sharpe, Yale & Towne, General Electric, Westinghouse, and also Ford (in Highland Park, Detroit) have a systematic apprenticeship policy. But the whole Ford factory, with its 110,000 workmen, has now only about 900 apprentices or less than 0.9 per cent. The General Electric plant at Lynn, with 12,000 workmen has 220 apprentices or nearly 2 per cent. This, compared to Germany, is relatively insignificant.

A very interesting example of co-operation between college and shop is to be found in the "Cincinnati plan" sponsored by Dean Hermann Schneider and the Board of Trustees of the University of Cincinnati. Students of the Engineering Department of that university after the first half year devoted to study alone, divide the remaining 4½ years between college and factory, alternating every four weeks. To make it easier for all concerned, students are divided in groups of two alternating their work in both institutions and among themselves. The plan seems to have given excellent results from all points of view. But attention must be called to the fact that up till now in that particular college only production engineers and no designers have been graduated as Bachelors of Science in this manner.

Another interesting example of this kind is the Technical High School in Springfield, Vermont, where apprentices of 16–18 years of age are trained. Here the pupils alternate every two weeks. In this case the experiment deals with 50–60 young men, but the town has only 7,200 population, and half of this number are workmen.

Gage Steel Investigation

Investigations regarding the properties and behavior of gage steel, by the Gage Steel Committee of the Bureau of Standards, are developing some interesting points. Slow wear, or long life, is obtained by a rapid cooling from a high quenching temperature; in other words, extreme hardness is a desirable factor in gages.

Size seems to affect the tendency toward cracking. Specimens ½ in. in diameter did not crack in oil quenching, but did crack after quenching in a mixture of water and glycerin. The ¾-in. specimens were even more susceptible to cracking than the 1 inch.

The various tests indicate that a certain consistency can be traced in spite of apparent contradictions. The rapidly cooled small specimen and the slowly cooled large specimens cracked readily. Only the slowly cooled small specimens and the rapidly cooled large pieces failed to show cracks when etched deeply. The general opinion that the stress is more severe after the cooling rate, evidently requires modification. The stresses seem to be tensional for slowly cooled and compressional for rapidly cooled pieces.

These observations indicate that water quenching is safe for simple, solid shapes in large sizes, but that continuous oil quenching is not safe for intermediate sizes. The principles developed show that the best method to obviate cracking upon oil quenching moderate sizes, is to prevent the generation of high stresses by reducing the temperature drop before the surface becomes effectively elastic. Tempering immediately after hardening has been found to reduce the tendency toward cracking.

Those interested in further details should consult the Progress Report of this committee.

Book Reviews

Mechanical Underground Loading in Metal Mines. By Charles E. Van Barneveld, Mining Engineer, U. S. Bureau of Mines. Six hundred thirty-nine pages, 5¾x9 in., paper covers, illustrated.

This book, Vol. 7, number 3, is published as co-operative work between the U. S. Bureau of Mines, Mississippi Valley Station, and the Missouri School of Mines and Metallurgy. An attempt has been made to view historically the development of breaking, loading and transporting in metal mines. Many accurate and detailed costs show the effect of proper and improper mechanisms for the handling of ore. It is pointed out that savings effected through efficient handling methods do not reduce the number of men employed, as is often thought, but rather widen the definition of ore, include material heretofore unprofitable, cause expansion of operations and the consequent hiring of more men at better pay. The advantages of using locomotives of the steam, electric, gasoline or battery types are discussed, the discussions containing cost figures and data on tonnage capacity and methods of operating.

The information contained in this book will be found of value to the executives and operating officials of mining concerns as a reference for cost comparison of ore transportation in metal mines. A portion of the contents has been furnished by operating mining concerns and manufacturers of underground loading machinery, and the inclusion of 225 illustrations greatly assists in showing the advantages of modern equipment, based on actual operation and practice.

Faster Milling for Greater Profits. By Haynes Stellite Co., 30 East 42nd St., New York City. Sixty-three pages, 8½x11 in., paper covered.

The use of Haynes Stellite for milling cast iron, semi-steel, malleable iron and similar metals is discussed in this book, and valuable information pertaining to the successful application of this alloy as a metal cutting tool is submitted, so that the shop man can obtain results, affording longer tool life and increased production. The correct speeds and feeds, the methods of grinding cutters and the angles that should be used for applying stellite for the machining of various metals are shown so that the full advantages offered by this type of tool may be obtained.

The importance of properly adjusting machines is explained and a number of points are mentioned that should be considered before applying stellite for machining purposes are worthy of notation. A number of half-tones and line cuts illustrate practical applications of setllite milling cutters, and the data that is furnished in this book will be of value as a reference for the shop using milling cutters.

Automobile Starting, Lighting and Ignition Systems. By Victor W. Page. Seventh edition, eight hundred ninety-two pages, 5x7½ in., 563 illustrations, cloth-board covers. Published by the Norman W. Henley Publishing Co., 2 West 45th St., New York, N. Y. Price $3.

The data contained in this book have been prepared to furnish the non-technical reader a comprehensive explanation of all forms of automobile starting, lighting and ignition systems, used with various automobile engines. Electrical knowledge is not necessarily required to understand the electrical principles that are discussed, as an elementary basis is offered through clear description and well arranged illustrations.

There are three hundred and twenty-five wiring diagrams shown, covering the most popular makes of automobiles, that will enable a person not versed in ignition systems to familiarize himself with the necessary fundamentals that are required for inspecting and repairing purposes. Descriptions are made of storage-battery construction, charging and maintenance, magneto-distributor timing, care of motors and generators and systematic location of electrical faults. This book should be of value to the motorist, student, mechanic and repair man, for whom it is primarily written.

Strength of Materials. By Edward W. Maurer and Morton O. Withey. Three hundred seventy-seven pages, 5¾x9 in., cloth-board covers. Published by John Wiley & Sons, Inc., New York, N. Y. Price $3.50.

This book has been prepared as a textbook for the students of engineering whose study covers the strength of materials and materials of construction. It has been aimed to show these subjects in a teachable book so that the student can efficiently gather the necessary requirements pertaining to definitions, demonstrations, proofs, solved illustrative examples and problems. The chapters include stress and strain, mechanical properties of materials under simple strain, typical problems involving simple stress calculations, stresses in beams, ultimate strength of beams, stiffness of beams, special beams and loading, torsion and columns.

The information shown will assist in determining the strength, stiffness and the security of structures or machines by means of mathematics. The treatment is based in part on hypotheses or assumptions, being described by the aid of many formulas, tables and illustrations. Various classes of metals in different shapes and forms are described and treated, so that the volume well covers the course of instruction in the strength of materials.

Nichrome Castings. By Driver-Harris Co., Harrison, N. J. One hundred nineteen pages 5x7¼ in., paper cover.

This booklet aims to lay before the heat-treater, in language that can be readily understood, information rendered available by recent investigations for carburizing and case hardening, cyanide hardening, gas carburizing and lead hardening. The contents is based on actual operations conducted in the present-day practices, and includes various methods and temperatures used for the heat-treating of various metals. The mechanical requirements of different case-hardened parts vary widely according to their functions and to cover such methods as are needed in every-day use, the data will be of value and serve as a useful reference for the heat-treater and shop man. Many illustrations are furnished to show the various principals involved.

A description of "Nichrome" castings is included, showing the general uses, physical and chemical characteristics, carburizing containers, stock patterns and special castings as prepared by the Driver-Harris Co.

A Compound Die With Interchangeable Sections

By Jack Williams

Dies with symmetrical sections, each of which has two cutting edges — Reversal and transposition of sections bring the new cutting edges into use

THE tools here illustrated are used to perform the four operations necessary to produce the knob, or "striker," of the "Bostitch" wire-stapling machine—a device to be found on the desks of most up-to-date offices, and used to fasten together the several sheets of a long letter or other document—and were

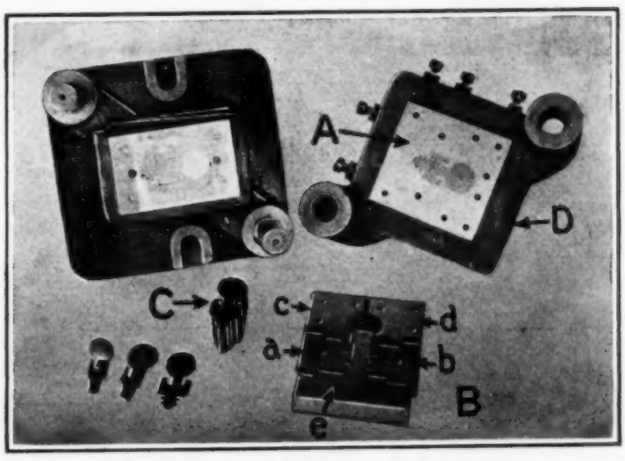


Fig. 1—Compound sectional blanking die

designed and constructed in the toolroom of the Boston Wire Stitcher Co. at East Greenwich, Rhode Island.

The feature of greatest interest to toolmakers who may have similar problems, is the symmetrical design of the blanking die which is made up of five sections of such shape that by turning over and transposing the parts, either cutting edge may be used in whole or in part. This construction involves a little more care in laying out, but the trifling cost of the extra labor in this respect is well repaid, both by the greatly prolonged life of the die and the rapidity with which a repair may be made when a slight accident to the cutting edge necessitates the tying up of a valuable, and perhaps much needed, press.

As is usual in the case of compound tools of this nature, the die is carried in the upper member of a pillar press. At *A* in Fig. 1, one of the dies is shown in the holder, while at *B* is another die of the same size and kind with the sections separated sufficiently to show the manner of construction. The die, of course, has no clearance, since the blanks do not pass through it, but are returned to the stock from which they are cut and pass out of the tools with the strip. The sides of the punch *C* are parallel so that it, too, may be inverted and the cutting edges of the opposite end brought into service. By this construction the die and punch, which were made originally of 1½-in. stock, may be used down to ¾ in. in thickness without difficulty.

When making the die-holder *D*, it is quite essential that the two sides of the pocket opposite to the setscrews be made square with each other. Care must also be exercised to make the die itself square, and, as before stated, the layout must be central so that the die-sections will match equally well either way up.

The combined parts of the die are held together and in the die holder by the pressure of setscrews in two directions, and are further secured by fillister-head screws passing through the holder from the back and screwing into the die-sections. These screws are ¾ in., and the clearance holes through which they pass are made ⅛-in. or so larger in diameter so that no sidewise restraint will be imposed upon the die sections when they are brought to bear against the squared sides of the pocket.

Returning to *B*, Fig. 1, it will be seen that this construction permits the sections *a* and *b* to be transposed and at the same time turned over, so that should the edge of either section nick or crumble during a run, the utility of the tool will be restored by this simple transposition instead of by grinding away the whole

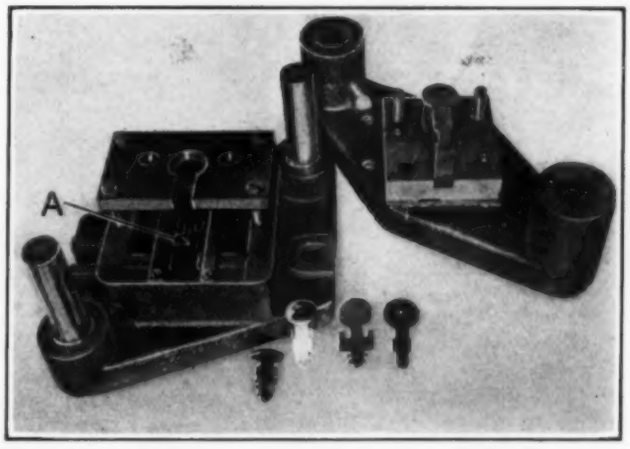


Fig. 2—Partial drawing and stamping tools

surface of the die. Parts *c* and *d* may be transposed in the same manner, while part *e* is restored to service by merely turning it over.

To one who is familiar with this type of die, the

sectional construction needs no further recommendation. With a single-piece die every little nick that occurs at any part of the cutting contour necessitates grinding down the whole surface a corresponding amount and thus sacrificing the useful life of the die. With this construction, should any piece crumble persistently, because of faulty steel or imperfect tempering, a new piece can be substituted for it at a fraction of the cost of a new die.

The material blanked by this die is 0.053-in. cold-rolled steel, and the wear upon the cutting edges is considerable. When one cutting edge has become dulled to the extent of burring the blanks objectionably, the holding screws are removed and the die turned over; an operation that can be performed in twenty minutes. When the second side has been used to its limit, the die is taken out and both sides reground before returning it to the holder, thus reducing the grinding time to little more than half of what would ordinarily be required, since two grindings are really done at each resetting. The reversible feature of the punch permits it to be treated in the same manner.

The second operation, performed by the tools shown in Fig. 2, is really two operations carried out simultaneously, the wings of the blank being turned at right angles and the trademark and operating directions stamped upon the knob. Though these tools have no cutting to do, the parts are made symmetrical and interchangeable as in the blanking die, and for the same reason.

In the lower member of this tool there are two stamps; one a round one that impresses the letters upon the round part of the knob, and the other, shown at *A*, being made a part of the spring plunger that supports the metal while it is being drawn. The first mentioned

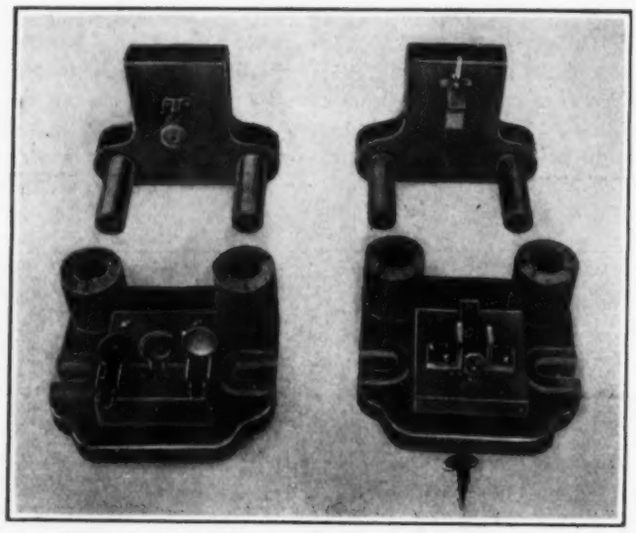


Fig. 3—Tools for the third and fourth forming operations

stamp is stationary and is attached to the bottom of the pocket in the holder, considerably below the level of the other stamp. As the punch descends upon the blank the latter is gripped between it and the stamp *A* upon the plunger. Continuing its descent against the action of the springs, the plunger finally bottoms in the die-holder, at which time its lettered surface is level with that of the other stamp, and the impression pressure is delivered upon both at the same time. The springs of the plunger-stamp cause the partly-formed blank to follow the punch as it ascends, and it is stripped from the punch by the spring stripper.

The third and fourth operation tools, shown in Fig. 3, are comparatively simple forming dies and punches. As will have been noticed, the punch of the second-operation tools impresses a "dimple" in the round part of the blank at the same time the letters are stamped, and this dimple serves to locate the piece in the succeeding operations.

The parts lying upon the die to the left show the transformation that occurs at this stage, while the finished part, ready for polishing, may be seen in front of the tools to the right.

Preventing Hot Boxes

By C. G. Williams

One of the things, if not the one thing, that causes the most grief on railroads is the epidemic of hot boxes that occasionally visits all divisions. The troubles seem to gain gradually, so that one is hardly aware that they are gaining until they bloom into a full-fledged

Oiler's Report on Engine No. _____

Driving cellars examined	Yes	No	Truck cellars examined.	Yes	No

Driving cellars packed			Perforated plates removed and cleaned		
No.	Right	Left	No.	Right	Left
1			1		
2			2		
3			3		
4			4		

Eng. truck cellars examined	Yes	No	Trailer truck cellars examined	Yes	No

Cellars packed			Cellars packed		
No.	Right	Left	No.	Right	Left

Note:-- All perforated plates must be removed and cleaned whenever grease is put in cellars.

Signed, _____

Oiler's report

epidemic, at which time every one goes after the thing that causes so many engine failures and delays so many trains. To my knowledge, no division on any railroad have ever been immune from this epidemic, which has been classified as being due to pure and unadulterated carelessness on the part of the workers.

During the shopmen's strike of 1922, the divisions on each side of the point where I was stationed had epidemics of hot boxes, and we received our share as a sort of inheritance from the other two divisions, for the M. M. who had charge of the three divisions had decreed that engines should run first in, first out, regardless of direction or home division.

As soon as it was noted that the epidemic had started, I determined to rid our division of the nuisance and, if possible, to see that no hot boxes occurred on engines leaving that division in either direction. With this thought in mind, and knowing from past experience that if the perforated plates on top of the grease in the cellars were kept clean and free from burned or dead grease, there would be not hot boxes, I evolved the form as illustrated for the use of oilers at the roundhouse, working to impress upon the minds of the oilers the necessity of looking after all cellars and perforated plates. Within a period of eight months not one hot box was reported on any of our engines.

It has been said that railroads use too many forms, but the addition of this one form proved a blessing, not only to us, but to the divisions on each side of us.

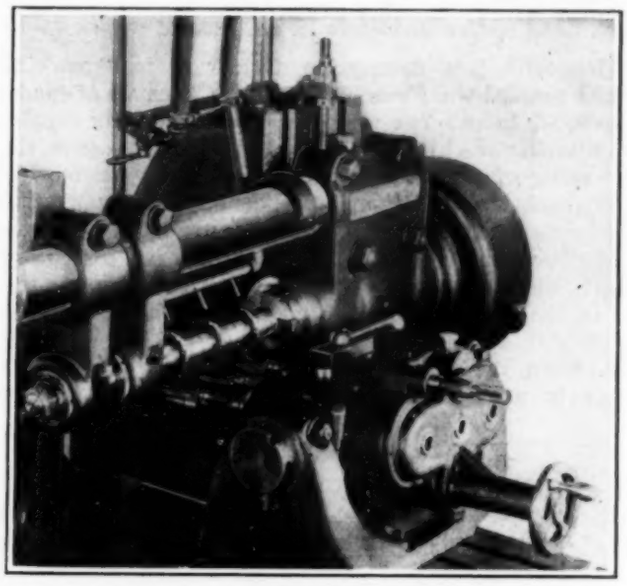
Ideas from Practical Men

The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from five dollars upward, according to their merit

Special Milling Fixture for Fluting Taps

BY HERBERT F. CRAWFORD

The milling fixture shown was designed for the fluting of combined drills and taps used in manufacturing plumbing goods. The head holds three taps, each of which is set in a tapered hole and located by a keyway in the shank. The taps are held in position by the end pressure of the cupped tailstock-centers. All three centers are clamped by a single lever and can be advanced or withdrawn simultaneously by a handwheel, thus providing compensation for any allowable



Special fixture for fluting taps

variation in the length of the taps. The taps are ejected by a knockout after the tail centers have been withdrawn.

The index head and the footstock are contained in one large casting trunnioned in a bracket on the table of the machine. The tailstock end of the casting is moved up or down by two rack- and pinion-operated horizontal plungers. The plungers have angular faces and act on tapered surfaces on the under side of the casting. The pinions operating the plungers are mounted on a shaft carrying a crank at its outer end, the crank engaging a pair of stops on a bracket attached to the fixture. The forward movement of the table brings one of the stops in contact with the crank and revolves it, forcing the two plungers to move toward the trunnion bearing of the fixture. As they move forward they slide underneath cam surfaces on the tailstock end of the fixture and elevate it. After the plungers have moved a certain distance the crank passes out of contact with the stop. The fixture is held in the elevated position until the other side of the crank engages another stop on the bracket. Further forward movement of the table causes the crank to rotate in the opposite direction, thereby withdrawing the plunger from under the tailstock end of the fixture so that the fixture is lowered at that end. By this means the flutes in the tap are cut on a taper while those in the drill are cut parallel with its axis.

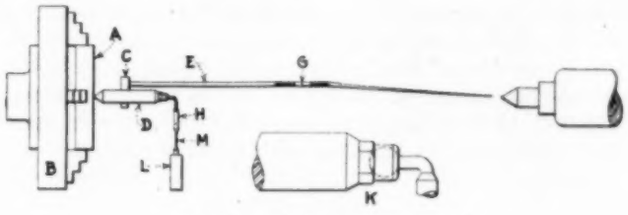
All this takes place without any attention on the part of the operator, who simply removes and replaces the taps, indexes the heads and starts the machine on its cycle. The fixture was designed and built by the Cincinnati Milling Machine Co. for use on one of its 48-in. automatic machines. The taps are of high-carbon tool steel and are milled at the rate of approximately 85 ft. per min. with a speed of 4¾ in. per min. The time per piece is 0.55 minute.

An Inexpensive and Reliable "Wiggler"

BY S. B. RICHEY

Herewith is a sketch of an improved form of center tester or "wiggler" that is easily made and convenient to use.

The work to be centered is shown at *A*, in the chuck *B*. *C* is a taper pin that can be easily inserted in and removed from the body *D*. The pointer *E* is jointed at *G*, so that it can be taken apart and put away in a small



A wiggler that is easily made

space. The part *H*, shown full size at *K*, is a ball and socket joint from the throttle control of an automobile.

A piece of steel to fit the toolpost is indicated at *L*, to which is joined the part *H* by the small rod *M*, the latter being flattened to form a spring. The advantages of a tester of the type shown are, that if the lathe carriage should be accidently moved the "wiggler" will not fall, and that a convenient means is provided for holding it in the toolpost.

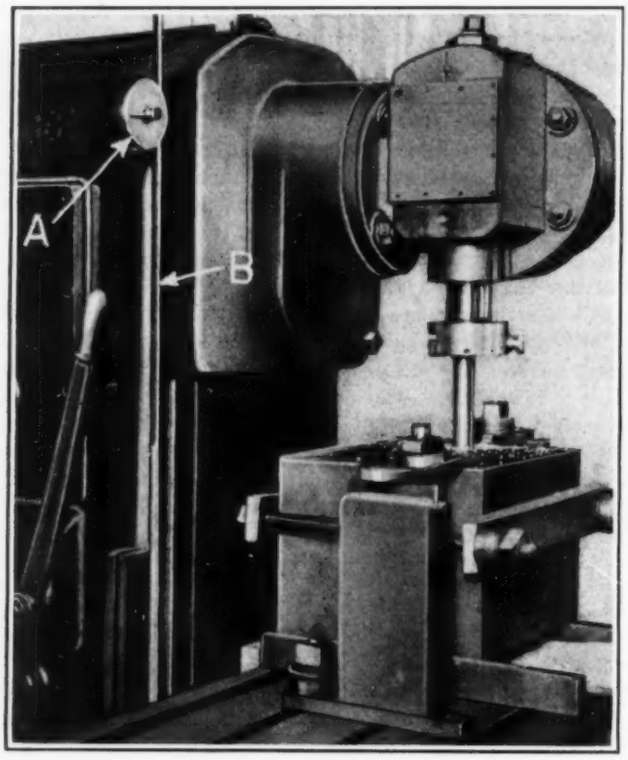
IDEAS FROM PRACTICAL MEN

A Depth Gage for the Milling Machine

By W. E. Buck

By the use of the depth gage shown at *A* in the illustration, the operator of the milling machine can tell just how far a drill or boring tool is below the surface of the work. The device is shown on a Milwaukee milling machine, where the boring bar is engaged in boring to a shoulder at a certain depth.

In operation, the cutting tool is brought against the surface of the work and the indicator on the dial set



Device for gaging depth of cut

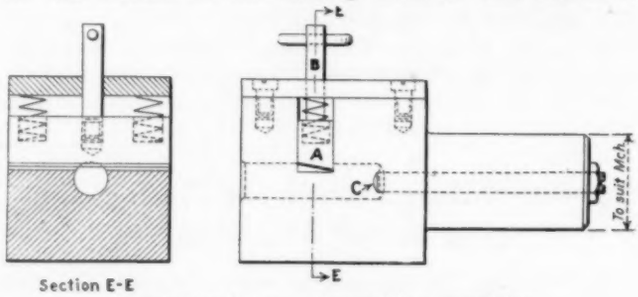
to zero. The depth of the tool can be told from the dial at any stage of progress. The movement of the indicator is controlled by the long rack *B*, the lower end of which is attached to the knee of the machine. One revolution of the indicator corresponds to a 10-in. vertical movement of the knee. When used in connection with the graduated collar on the elevating mechanism, depths can be controlled with great accuracy.

A Pull-Head for a Broaching Machine

By Norman E. Brown

The pull-head shown in the sketch is intended for use in a broaching machine, on work where it is necessary to remove the broach at the completion of each cut. The head has a reamed hole in the center, in which the shank of the broach is a slip fit. The tongue of the sliding member *A* fits in an angle, forming a latch which engages an angular notch in the shank of the broach. The guide pin *B* serves to locate the sliding member sidewise and also to raise it for the removal of the broach.

When the operator pushes the broach into the head, the end of the shank comes in contact with the angle on the bottom of the sliding member and raises it



A pull-head for a broaching machine

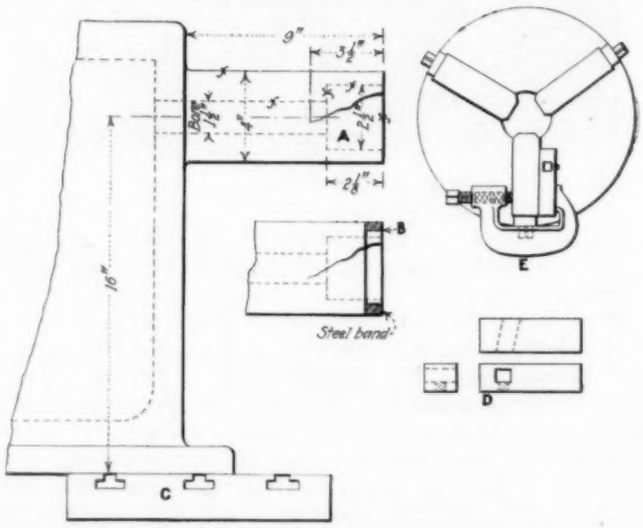
against the pressure of the spring shown, enought to allow the boach to pass under so that the latch engages the notch in the shank. To prevent the shank from going too far in the head, the stop screw *C* is provided.

How an Emergency Repair Was Made

By Raymond H. Dauterich

Herewith is a description of how a small machine shop handled what was a difficult job, because of inadequate facilities. The work consisted of making repairs to a broken machine-part for a large packing house, the breaking of which caused a serious delay in moving perishable foods, as well as making idle many employees. For this reason speed was urgent and no time could be lost sending to the manufacturer for a new part, which was a very expensive part anyhow.

In the drawing, the broken part of the machine is shown at *A*. It was cracked through the extended arm as shown, the break going clear through to the opposite side in a zig-zag manner. It could not be welded



Improvised rig for an emergency repair

without machine work afterward, so it was decided to turn down the end and shrink on a steel band as shown at *B*.

IDEAS FROM PRACTICAL MEN

The turning process called for what the writer terms ingenuity and since the method was unique, I am sure it will interest the readers of *American Machinist*. There was no boring mill, large lathe or anything of that sort close at hand, but there was a No. 2 universal milling machine.

The base of the large casting was rough, and after clamping it to the table it was leveled and aligned with the machine spindle. A view of just about how it sat on the milling machine table is given at *C*. A three-jaw, universal chuck that was part of the milling machine equipment was used as a driving head for the toolholder. The toolholder was made of ¾-in. cold-rolled steel and is shown at *D*. The hole through the toolholder was made on an angle to give clearance to the tool. The toolholder was clamped to one jaw of the universal chuck by the use of an ordinary C-clamp, as at *E*. Simply moving the jaws in or out with the regular wrench, gave the tool the proper adjustment.

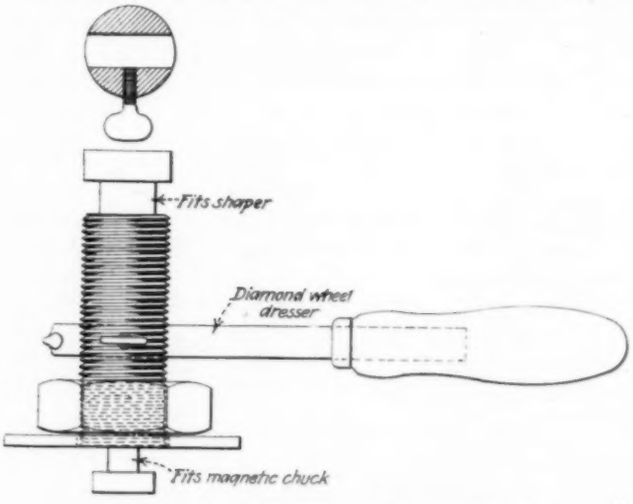
Many mechanics would have recommended putting a 1¼-in. bar through the bore of the arm and using an offset tool. This could not be done since only 1 in. of saddle movement on the knee was left after the job had been set up. It was necessary to use a clamp to close the break in the casting while the turning operation was in progress and until after the steel band had been heated and placed.

A Holder for a Diamond Tool

BY THEODORE KRUGER

We have a B. & S. surface grinder fitted with a Heald magnetic chuck and have always used the vise to hold the diamond when truing the wheel. In case the wheel got dull or glazed and we had a job in the chuck, we had to remove the job to hold the diamond.

Our magnetic chuck has a T-slot on the surface and



Double-end holder for a diamond tool

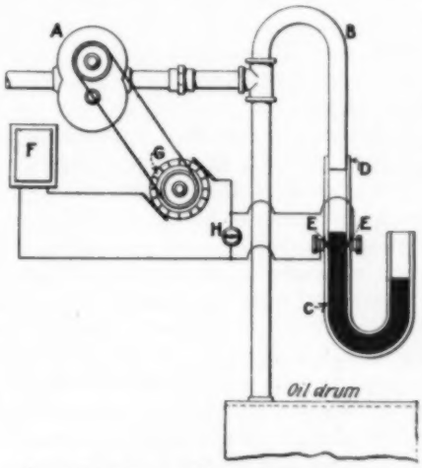
I made a double-end holder for the diamond, as shown in the sketch. We use this holder on the magnetic chuck and also on the shaper, which we often have to use for grinding, using a toolpost grinder. The holder also fits the T-slots in our lathe faceplates.

An Automatic Stop for an Oil Pump

BY GEO. G. MCVICKER

When pumping the oil from the drums or barrels in which it is shipped, to the storage tanks, there is often time wasted in watching the operation, so as to be at hand to stop the pump when the drum has been emptied.

An addition to the pump that will automatically stop the pump motor when the oil stops flowing, is shown in the accompanying drawing. In the illustration, *A* shows the rotary pump driven by an electric motor *G*, taking its current from the lighting circuit at the switch box *F*. A tee is substituted for the elbow where the suction line drops to the oil drum. From the top of the tee, a small copper pipe is fitted and bent to a return as shown at *B*. A glass tube *D* is heated at points *EE* in a bunsen burner and two pieces of platinum wire, taken from a burnt-out electric bulb, are fused in the glass, one on each side. Three inches from the point of fusing-in the contact points, the glass is again heated and bent to a return as shown. The glass is then attached to the end of the copper tubing *B* by means of cement, and filled with mercury until the latter stands ¼ in. below the contact points. A cork is then fitted in the open end of the glass tube.



An oil pump with automatic stop

From one side of the motor-lead, a wire is connected to one of the platinum contact points on the glass tube and the other contact platinum point is connected to the opposite side of the lighting circuit. A snap switch is placed at *H*, so as to short across the leads to the platinum points when closed.

The drum of oil is set in place and the suction pipe placed in it. The switch *H* is closed, which throws the current through the motor, and the pump starts. As soon as the suction is sufficient to discharge the oil to the storage line, the mercury rises in the tube because of the suction on it as well as on the oil. When the mercury reaches the platinum points a circuit is closed through them and the switch *H* is turned off. The mercury stands in this position and makes the connection between the two points so long as the suction holds it there, but as soon as the oil drum is empty and air enters the suction pipe, the suction on the mercury ceases and the mercury drops to its level, thus breaking the circuit to the motor.

The height of the mercury will depend somewhat on the height the oil has to be lifted, although the height it rises above the points does not change its working so long as its stands below the points when the pump is not working.

Practical Shop Problems

Questions of a Practical Nature will be answered in these columns

Grease as a Lubricant

Q. We use grease cups on many of the bearings of our machinery. The grease works nicely for a time and then begins to clog until it often becomes impossible to turn the cup down. It then has to be taken off and a hard substance cleaned out. We have been told that high-pressure grease fittings will solve our problem. Please let us have your ideas.

A. Part of the difficulty will be remedied by installing the high-pressure system as, with it, the passages in the bearing can be purged to a greater extent.

The high-pressure system alone, however, will not necessarily give the proper lubrication to the bearings as the grease itself is a very important factor.

Ordinary grease is oil containing a binder presumably tallow or its equivalent which makes it non fluid at ordinary temperatures. There are greases on the market in which binders are used that have no lubricating properties in themselves and the oil used is of an inferior grade. When this grease becomes heated the oil separates out leaving the binder behind. It is this binder that clogs the grease cups and passages of the bearing. There are also greases which are all oil with a cold-test point high enough to render them non fluid at ordinary temperatures.

It is a comparatively simple matter to test a given grade of grease to find what it will tend to do in service. Heat a small quantity in a cup until it melts and observe the quality or body of the oil released and the quality and proportion of the separated non-meltable solids. Comparison of a number of samples by means of this test will show which greases may be expected to function and which are obviously unsuitable.

Tracing Production

Q. We are operating a business making small valves and gas fittings. Recently, as a result of our careful investigation of individual machine operations, we were able to make a number of improvements to speed up production. In fact operators who used to be continually behind can now run themselves out of work.

We believe there are other opportunities which are not apparent to us because we are too close to the work to see them and it occurs to us that you may have a suggestion.

A. One statement in your question may be an indication of further opportunity to save that we suggest you look into. We are unable to give direct advice, knowing nothing about your layout, but we venture the opinion that if your operators can now run themselves out of work something may need to be done with the material handling between operations.

The point can be tested simply by a plan which you can follow if you are not already following it. Prepare a fair-sized layout of your productive sections, spotting the main aisles, the material storage stations and the machines. Then, with a colored pencil, trace the course of the component parts wherever they go and in the order they take from start to completion. Study this chart, and you will likely find some surprising points on which you can work to advantage.

Capacities Required for Bolt Heading

Q. Have you any information on the pressure required for working various sizes of bolts in a bolt-heading machine?

A. The pressure must be sufficient to overcome the compressive strength of the material to force it beyond its yield point and cause it to "flow" into the shape of the header die.

Many factors including the physical properties of the material, the working temperature and the heat absorption by the dies, the design and condition of the dies and the speed of forging have an influence on the resulting figure. It is therefore possible only to make an approximation from a practical standpoint.

Theoretically a figure may be set by multiplying the area of the head to be formed, by the ultimate strength of the material, by the factor of safety on which the design is based and by the per cent factor of the material strength existing at the working temperature. This figure may then be reduced to tons capacity if so desired. Also see Kent page 1736, tenth edition.

Tables of reduction in strength of materials at varying temperatures are available in the standard handbooks as are other tabulations for judging temperatures by color. Both of these may be used to help in the calculations. Following is a list of approximate values:

Color	Deg. F.	Strength Per Cent
Dull red	1,080	30
Dark red	1,290	19
Dull cherry	1,470	13
Cherry	1,650	10
Bright cherry	1,830	7
Orange red	2,010	5
Orange yellow	2,200	—
Yellow white	2,370	—
White welding heat	2,550	—

A problem can be worked out by making the following assumptions:

Area of finished head 1.5 in.

Pressure to break down material 90,000 lb.

Factor of safety 4.

Temperature factor 10 per cent for working temperature of 1,650 deg. F.

$$\frac{1.5 \times 90{,}000 \times 4 \times 0.10}{2{,}000} = 27 \text{ tons}$$

Were the temperature reduced this capacity requirement would be increased correspondingly.

Technical Abstracts

Economies of Labor Saving Equipment

This paper, which is somewhat mathematical and tabular, develops five simple equations for determining the economies of an installation of labor saving equipment. They show the maximum investment which will earn simple interest; the yearly cost to maintain the mechanical equipment ready for operation; the yearly profit, in excess of simple interest, from the operation of the equipment; the yearly profit from operation, in per cent on investment; and the years required for complete amortization of investment out of earnings.

The method of applying these formulas, the evaluation of their various factors, and the correct assumption of bases are explained in detail. The calculation of a labor burden account, as distinct from the ordinary factory burden account, and the transfer of certain items from the regular burden account to a special productive labor payroll account are recommended and explained. Standard forms to systematize investigations are worked out.

With this paper should also be read the one on page 408 of the same issue, in which a specific application of the formulas is applied to the purchase and operation of an electrical industrial truck in place of hand trucks. The work done by the electric truck is described and the description is followed-up by an analysis of the saving its adoption effected.

The papers are by James A. Shepard, George E. Hagemann and George Langford, Jr.—*Mechanical Engineering*, May, p. 403.

Dirty Steel

Engineers are realizing more and more that steel intended for important uses, where serious stresses will be encountered, must not be full of non-metallic inclusions if a reasonably long life is desired. It is even being stated in specifications for some of the more troublesome parts of machinery, that the steel may be rejected if found with the microscope to be "dirty." The recognition of such a cause for rejection of material makes it necessary that the metallographic test for "dirty steel" should be carried out in a skillful and reliable manner.

George F. Comstock, metallurgist, Niagara Falls, N. Y., describes the precautions necessary in preparing for proper estimation of the degree of dirtiness or cleanness of steel, and to show how easily various accidental surface appearances on a polished section may be mistaken for evidence of "dirt" embedded in the metal. There is no standard definition of "dirty steel" as yet, and furthermore no ingot of steel has ever been cast in which there could not be found some traces of non-metallic inclusions by examination at high magnification. Therefore, great care should be taken in selecting the proper specimen and in judging of the final results. Generally speaking, great care should be used in handling the polished surface, so that only non-metallic inclusions will show up.—*The Iron Age*, April 23, p. 1135.

German Lathes in 1925

No startlingly new developments in German lathe design have occurred during the past year. The use of individual motors has spread still more. Dr. Eng. N. Buxbaum, in Charlottenburg, feels the best arrangement to be that of a motor attached by means of a flange to the headstock housing. For the cutting of accurate threads and for high-grade finishing he feels that the soft belt drive is superior to the direct electric drive.

Sliding change gears are preferable to swinging ones. The last mentioned, however, are all right for the high-speed sets where the tooth pressures are low. The swinging gears should be locked preferably by screws so as to make sure their staying put for rotation either way.

The author gives some figures for the intentional inaccuracies introduced to compensate for distortion. In order to avoid bulging surfaces in facing, the support should be scraped with a 0.01 mm. slant to the left. Centers of headstocks and tailstocks must be 0.01 mm. higher than the outer ends in order to compensate for the weight of the workpiece, etc. The following German tools are described with illustrations:—Lead screw lathe of F. A. Scheu, similar to LeBlond lathe; a semi-automatic with centers of Heinemann Bros.; a horizontal electrically driven boring mill of A. Wohlenberg; a screw lathe of G. Kraeger, A. G.—*Zeitschrift des Vereines deutscher Ingenieure* February 28, 1925, p. 261.

Wage Scale

Merrill R. Lott, of the Sperry Gyroscope Co., discusses that particular phase of industry dealing with the payment of different wages to different classes of employees. Payment is often made on the basis of the prevailing wage, and Mr. Lott endeavors to establish a more scientific method and elaborates a series of wage scales. Diagrams show how wages can be graded to agree with certain factors.

Some of these are, for example, the time usually required for a man to become highly skilled in his occupation; second the time usually required for a man skilled in an occupation to adapt himself to the particular condition that exists in the employing company; third, the scarcity of men following a trade in a given locality; fourth, the difficulty an employee would experience in securing similar work elsewhere at similar earnings; fifth, the value of an education; sixth, the prevailing rate of pay; seventh, the degree of skill and accuracy required; eighth, the money value of parts worked upon and equipment used and possible loss to the company through errors; and finally the value that can be placed upon the integrity and honesty of effort of an employee, his exposure to health and accident hazards and physical effort required.

A rating by means of points is given for these factors from which a more scientific wage schedule can be deduced.—*Management and Administration*, May, p. 451.

American Machinist

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KENNETH H. CONDIT AND FRED H. COLVIN, *Editors*

Collection of Statistics Is Not Illegal

THE decisions handed down by the United States Supreme Court in the cases of the Government vs. the Cement Manufacturers' Protective Association and the Maple Floor Manufacturers' Association are of vital interest to trade associations throughout the country. According to these decisions it is lawful for trade associations to collect and disseminate business statistics so long as such activity does not result in anything contrary to the Sherman Act. The majority opinion admitted that statistics so collected might be used illegally in restraint of competition but found that they had not been so used.

In the majority opinion Justice Stone said, "It is not open to question that the dissemination of pertinent information concerning any trade or business tends to stabilize that trade or business and to produce uniformity of price and trade practice. But the natural effect of the acquisition of wider and more scientific knowledge of business conditions on the minds of the individuals engaged in commerce and its consequent effect in stabilizing production and price can hardly be deemed a restraint of commerce.

"We decide only that trade associations or combinations of persons or corporations which openly and fairly gather and disseminate information as to the cost of their product, the volume of production, the actual price which the product has brought in past transactions, stocks of merchandise on hand, approximate cost of transportation from the principal point of shipment to the points of consumption, without reaching or attempting to reach any agreement or any concerted action with respect to prices or production or restraining competition, do not thereby engage in unlawful restraint of commerce."

In other words, the collection of business statistics for legitimate use is an entirely proper activity for trade associations. Just because statistics can be misused is no reason for prohibiting their legitimate use.

Developing Backward Countries with Reparations

WHEN your neighbor owes you money and offers to pay you in the same kind of product that your own shop makes, you're in a sort of a quandary as to just what to do. If you make lathes you don't want to be paid in lathes of his make. But unless he can sell the lathes to someone else there seems to be no other way for him to pay you what he owes.

That is the problem in making the Dawes plan of reparations work out in Germany. She hasn't the gold or credit, and the only way to get either is to sell products similar to those made by her creditors. Just how to do this will be the main problem considered at the meeting of the International Chamber of Commerce to be held in Brussels.

A plan brought out at the recent meeting of the Chamber of Commerce of the United States by Henry M. Robinson, a member of the Dawes committee, and Julius H. Barnes, former president of the Chamber, is to use German products for the development of backward countries. A French firm, for example, has made a proposal to the French government for the development of a port in Morocco, using German railway and port equipment for the work. The value of the products would, of course, be credited to the German reparations account. A somewhat similar plan is being considered by the Belgian government for developing their colonies in the Congo and Great Britain also has the plan under advisement.

While we would usually prefer pay in gold, when this is impossible, we must find a method that will secure our claim with as little disturbance to the world's business as possible. The proposed plan seems to afford a solution that, while it may not be ideal, does not take away markets on which the creditor nations have depended in the past.

Just Suppose

JUST suppose every machine tool builder were to indulge in every practice condemned by the Annexes to the Code of Business Principles presented at the last Convention. How long would it take for all the machine tool industry to be sold out by the sheriff?

When it comes to indulging in foolish and unethical practices, it is only a very small minority that are found doing these things because the great majority have found that they are bad business as well as bad ethics.

It is this small proportion that have brought out various business Codes of Ethics of various industries, finally culminating in the Principles of Business Conduct adopted by the Chamber of Commerce of the United States.

But, you say, "Why bother about the few people that do indulge in these practices? Nobody in his senses would indulge in all of them anyhow, so what's the difference?"

Yes, but—

Just suppose

Shop Equipment News

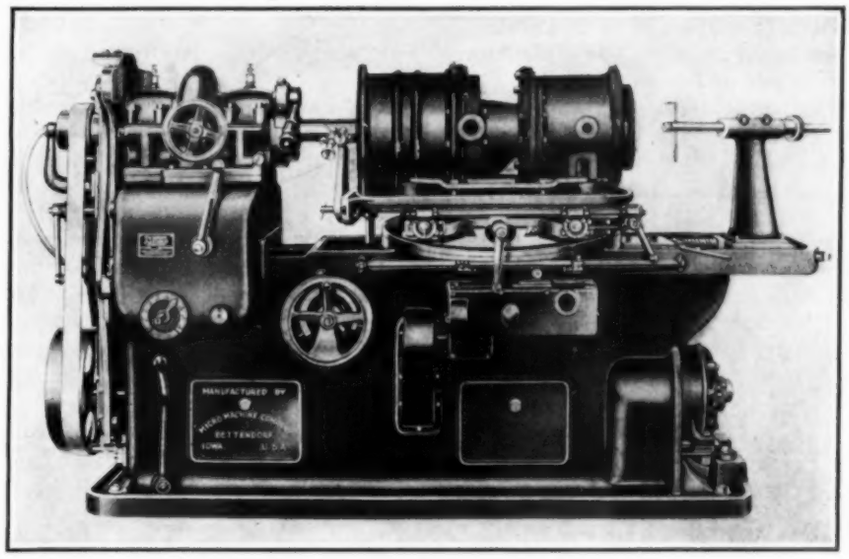
Micro Internal Grinder, Model FG

The internal grinder shown herewith has been placed on the market by the Micro Machine Co., Bettendorf, Iowa. It is intended primarily for the grinding of air-pump cylinders so that by the aid of a swiveling fixture the misalignment of the cylinders will be eliminated. By changing fixtures, it is possible to use this machine for a wide range of locomotive and air-brake parts such as side rods, links, crossheads and valves.

In operation, the entire pump unit is mounted on the swivel fixture, the front cylinder being centered by means of the spindle while the corresponding rear cylinder is centered by an indicator. This method of indicating locates the cylinder in alignment so that after the first hole is ground the fixture can be swiveled without further measurement. The lower portion of the fixture engages a hardened key or stop, allowing the fixture to rotate 180 deg., at which point the rear hole of the cylinder is in a position for grinding. A cooling compound is forced through the main spindle onto a baffle plate, keeping the path of the grinding wheel free from sediment.

The base of the machine is of the box-type construction, rigidly ribbed, with 4x64-in. bedways. The table measures 20x68 in. and has a center-rack drive. Automatic table travel of 30 in. is available, and, by means of hand operation, a total travel of 33 in. is provided. There are five feeds for various depths of cut, controlled by a quick-start and stop control. The swivel fixture is mounted on the main table so that ample vertical and horizontal adjustment for various sizes of pumps can be obtained. The alignment with the spindle is made by a hardened locating plunger engaging into slots in the fixture. A gear-type mechanism is arranged for swiveling the fixture by a hand crank. The headstock is of rigid construction, provided with a range of speeds for small and large hole grinding. Both power control and handwheel are provided for the revolving of main bearings for centering. The water supply, obtained from a 25-gal. tank, is delivered by pump pressure to the grinding wheel. The main headstock bearing, the table and reverse-gear box are provided with automatic lubrication, all other bearings being lubricated by a grease-gun. A diamond-dressing holder bracket, conveniently mounted, is provided with adjustment for various sizes of wheels. The floor space required is 29x91 in., while the height of the machine overall is 67 in. The net weight is 7,650 lb., less the motor.

The outstanding features claimed for this machine are that the grinding process for finishing eliminates distortion, insures straight and round holes, and that the accuracy and the finish produced insure high wearing qualities. The driving motor and drive mechanism are built into the base of the machine, making the grinder a self-contained unit.



Micro Internal Grinder, Model FG

Bethel-Player Crankshaft-Lapping Machine

The Bethel-Player Co., of Westboro, Mass., has brought out a machine designed for the purpose of lapping the crankpins and bearings of shafts for automotive engines. Its capacity at present is such that it will accommodate shafts up to seven bearings and six throws, the latter having a maximum stroke of six inches. The patterns are so constructed that the range of the machine can readily be increased if the market demands it.

The drive to the machine is by belt from an overhead line to a pulley within the base of the left end. The lever that may be seen projecting from the base on one end operates a friction clutch to stop and start the machine. At the opposite end of the countershaft, which extends throughout the length of the base, a 6-in. belt drives to a flanged pulley upon the live spindle. This belt and pulley are entirely inclosed by guards. The rotative speed of the spindle is about 250 revolutions per minute.

The main spindle runs in parallel bearings of bronze, and is given an

SHOP EQUIPMENT NEWS

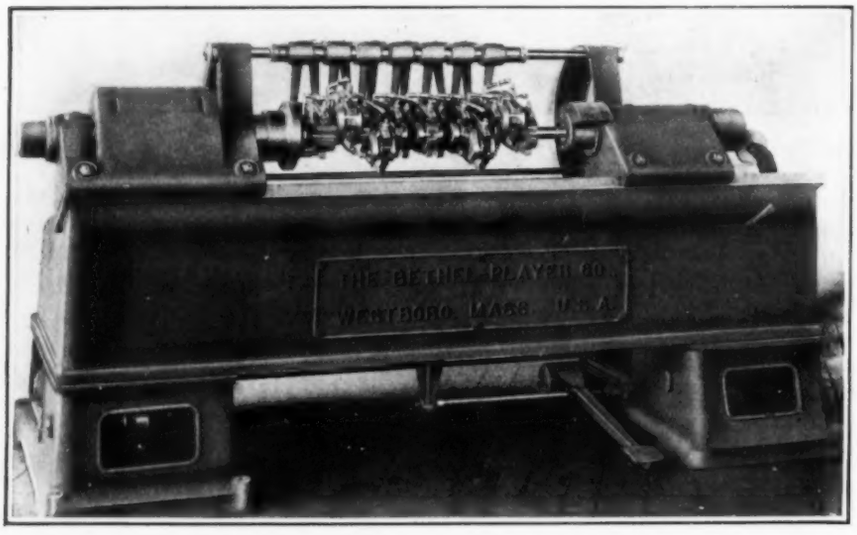
oscillating, or reciprocating motion by a bell-crank and disk which is driven from the countershaft through a silent chain. The ratio of the oscillatory movement to the spindle speed is 1 to 3½ turns. The amount of oscillation is readily adjustable from zero to 1½ in. The movement is transmitted to the spindle through a yoke that is fitted with ball thrust bearings.

The tail spindle is double and consists of a rotating member running upon ball bearings within a non-rotating sleeve that is free to move longitudinally against the action of a coil spring which holds the tail center in contact with the center in the crankshaft. The oscillatory movement of the headspindle is thus imparted to the crankshaft, and through it to the tail spindle. The tail spindle may be withdrawn for the purpose of dismounting and remounting a crankshaft by depressing the treadle, which is connected to the spindle by means of a flexible wire cable running over a sheave.

The lapping is done by two-part cast-iron laps that encircle the bearings to be lapped and are held rigidly together by means of a quick-acting toggle yoke so that the two parts constitute in effect a one-piece lap. As the shaft rotates the toggle-members move to and fro like the connecting rods of an engine, being pivoted at the free ends to the lower ends of levers that swing from the round bar at the top of the machine. Since the shaft to be lapped runs upon centers, the laps that encircle the bearings are, of course, stationary, but the manner of supporting the ends of the yoke-members is the same, so that any lap may be adjusted to operate either upon a bearing or a crank-pin at will.

The width of each lap is so calculated with reference to the length of the member it is to operate upon that a definite amount of end movement may be imparted to the shaft to cause each lap to cover exactly the active surface of the pin or bearing to which it is fitted. By virtue of the quick-acting yokes the laps may be released, the shaft dismounted, and the laps adjusted to a new shaft with very little loss of time.

The swinging levers that confine the outer ends of the yoke-members have a double bearing upon their supporting bar so that they may be adjusted lengthwise of the latter to come opposite the respective positions of the pins and bearings. When so adjusted they are locked against further endwise movement, but are always free to swing to the limits of movement imparted by the crank-throws.



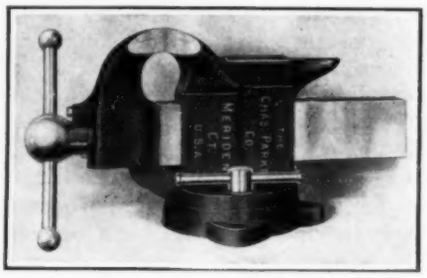
Bethel-Player Crankshaft-Lapping Machine

The material used upon the laps is a special abrasive that has been developed by the Bethel-Player Co. by long experiment and is claimed to be non-chargeable, particularly adapted to crankshaft lapping.

The machine occupies a floor space of 38x96 in. and weighs approximately 6,500 pounds.

Parker "Hercules" Garage Vise

The vise illustrated has been placed on the market by the Charles Parker Company, Meriden, Conn. It is intended for garage and machine shop use, and is heavier in construction than similar vises manufactured by the company.



Parker "Hercules" Garage Vise

Renewable steel jaws are milled, fitted and pinned on so they cannot work loose, yet can be easily removed if necessary. A swivel base, that can be suitably fastened in any position around the 360 deg. movement, is provided. A ring is expanded against the sidewall of the base by tightening a wedge with a bolt, affording a positive grip. The construction of the outside saddle permits the under portion of the vise to be cast solid. The handle used for adjusting the vise for various sizes is provided with a set screw and tension spring so that it is held wherever it is placed. The saddle and saddle screws are located on the outside so that lubrication can be easily provided. The vise is made in two sizes, having four and five-inch jaws.

Sleeper & Hartley Purchases Garvin Spring and Wire-Coiling Machines

The entire line of spring and wire-coiling machines manufactured by the former Garvin Machine Co., has been taken over by Sleeper & Hartley, Inc., 335 Chandler St., Worcester, Mass.

It is the intention to continue the manufacture of these machines and make any changes that may be necessary for their improvement. All repair parts for the machines now in use may be obtained from this concern.

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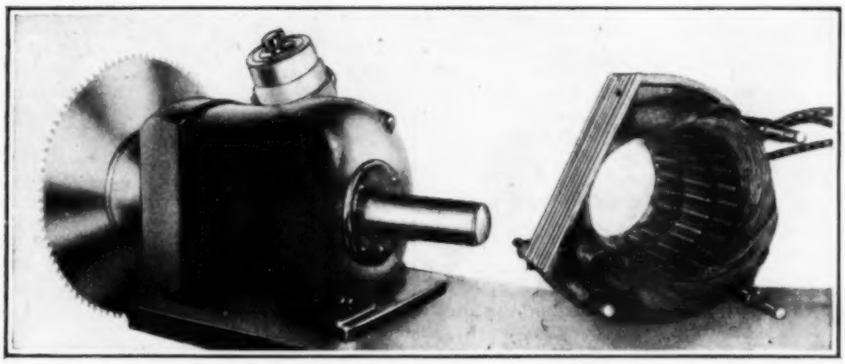
Forbes & Myers Motor for Circular Saws

Forbes & Myers, 172 Union St., Worcester, Mass., have developed a line of motors for circular saws that are similar to the three-phase induction type manufactured by this company, with the exception that one side is cut away to permit access to the saw.

The stator winding differs from the usual induction motor as all wires are omitted from one side, the unbalance being compensated for by the changing of the wires on the opposite side. The rotor is similar to the usual type, consisting of a cast-iron core mounted on a steel shaft. Through the core there are assembled aluminum bars that are welded together into an aluminum ring at each end. No insulating materials are used in the rotating member. The switch for operating the control of the motor may be mounted to suit.

The motor shown is ½ hp., 220-volt, 3 phase, 60 cycle that operates at 3,600 r.p.m. Similar motors for either 2 or 3-phase current of any voltage up to 550 volts and from ¼ to 5 hp. can also be obtained. The saw is mounted directly on the motor shaft, no bearings being required except the ball bearings on the motor itself.

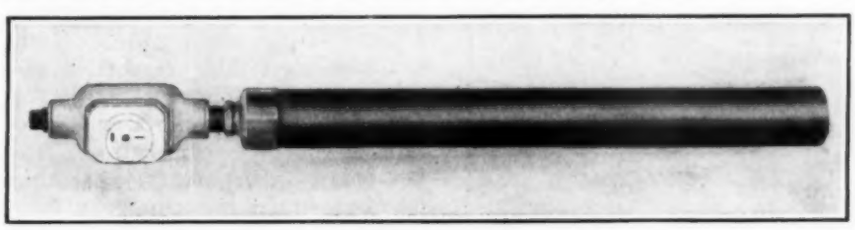


Forbes & Myers Motor for Circular Saws

It is claimed that since the saw is close to the motor, the action obtained is easier on the bearings than the usual belt, and that due to the absence of the belt it is impossible to overload the bearings by tightening the belt too much.

Trent Electrical Immersion Unit

The electrical immersion unit illustrated has been placed on the market by Harold E. Trent, 259 North Lawrence St., Philadelphia, Pa. It has been developed to meet the conditions incident for the melting of salts, such as lavite. The heating element is of the embedded type, packed in a steel tube to maintain a maximum of heat capacity. The temperature of the unit may be raised to 1,600 deg. F. before the initial heating of the salt takes place. The unit is made in sizes up to 1,500 watts and 18 in. in length with a constant diameter of 1.9 in. that has been found to be the most satisfactory size for general purposes. For the melting of other materials the wattage may be run higher, but care should be taken, as the salts under consideration are heat insulators and the thermo capacity of the unit is limited. The plug connection on the end can be supplied to suit.

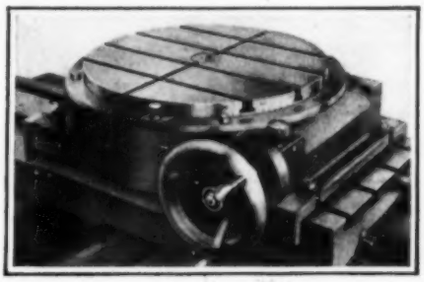


Trent Electrical Immersion Unit

Pratt & Whitney Circular Indexing Table

An indexing table, developed for use on machines where circular indexing is required, has been marketed by the Pratt & Whitney Co., 111 Broadway, New York, N. Y. The circular surface is 20 in. in diameter and is provided with four T-slots so that a variety of work can be applied.

The table consists of a cast-iron base and a circular top that has a wormwheel as an integral part, driven by a hardened and ground worm attached to a handwheel at the front part of the unit. The circular top is graduated in degrees for approximate indexing. For exact setting, a small slow-motion handwheel attached to the wormshaft, through a second smaller worm and wheel, is used. A graduated dial on the wormwheel shaft equipped with a vernier attachment permits an adjustment of five seconds, this being equal to 0.00025 in. on a 10-in. radius. One turn of the handwheel revolves the table 3 deg. A binder is attached to the table so that a desired position may be suitably locked during a machining operation.



Pratt & Whitney Circular-Indexing Table

The table is scraped on the under face and protected by two cast-iron lips that form a rest when its removed from the machine. Four T-slots are provided for the fastening of this device to the machine, making a self-contained unit that can be easily set up or removed. The table is useful for toolroom and production work and affords an accurate means of indexing.

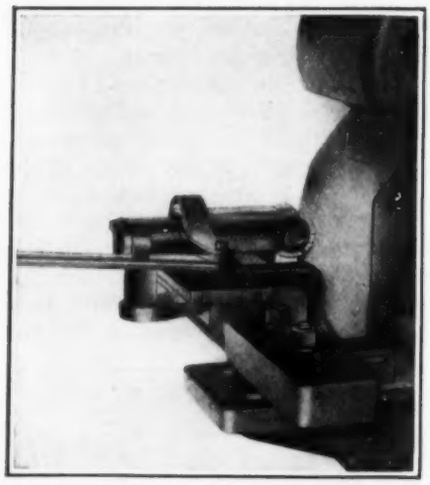
It is possible to use polar dimensions on the angle and the distance from a center, which is more rapid for laying out circular work than by using the right-angle dimensions, which is the usual custom.

SHOP EQUIPMENT NEWS

Ransom Abrasive-Wheel Truing Device

The Ransom Manufacturing Co., Oshkosh, Wis., has marketed the abrasive-wheel truing device illustrated suitable for the dressing of wheels up to 4 in. in width.

The unit is clamped to the toolrest of the machine and hand operated by



Ransom Abrasive-Wheel Truing Device

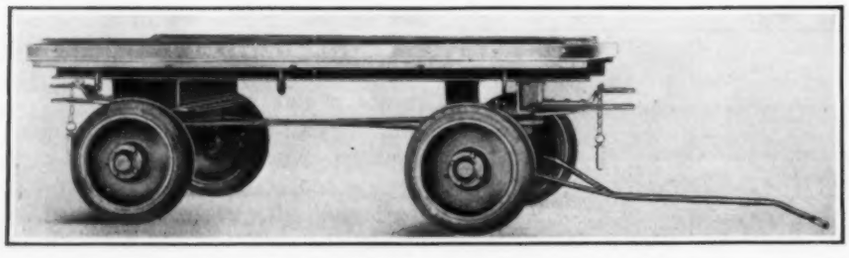
a lever so that the cutters traverse across the face of the wheel. Ball bearings are provided for the shaft that carries the cutters. Adjustment to suit the size of the wheel is made by a screw and handwheel located in the front portion of the device.

It is claimed that, with this attachment, grinding wheels can be trued to better advantage than with hand dressers, increasing their cutting efficiency and life.

Cowan Twin Fifth-Wheel Industrial Trailer

The twin fifth-wheel type industrial trailer illustrated has been brought out by the Cowan Truck Co., Holyoke, Mass. It is intended for general haulage work, and has a capacity of 4,000 pounds.

The unit is made with a 4-wheel steer and trailing handle that may be attached to either end. The wheels are 16 in. in diameter, equipped with rubber-tired wheels. The platform is constructed to overhang the wheels to protect them from unnecessary bumps. The dimensions of the platform are 36 in. wide, 72 in. long and 23 in. high. The weight of the unit is 750 lb. In addition to these specifications, the trailer can be furnished in special sizes.

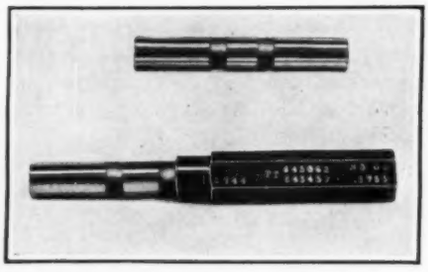


Cowan Twin Fifth-Wheel Industrial Trailer

Van Keuren Plug Gage

The Van Keuren Co., 12 Copeland St., Watertown, Mass., has brought out the plug gage shown in the illustration. A "go" and a "no-go" gaging member is made in one piece.

The feature of the gage is that the plug is provided with a "go" portion on either end and a "no-go" in the center. The plug is inserted into the handle with shellac, protecting one end from corrosion while the other is in use. When one end is worn undersize, the plug is reversed and a double life is therefore rendered.



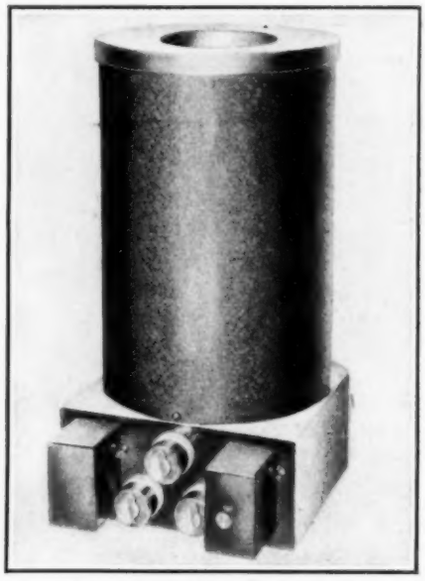
Van Keuren Plug Gage

Sizes larger than ½ in. in diameter may be used without a handle.

The gaging unit is made of a high-grade tool steel carefully hardened, ground and lapped. Accuracy of 0.00004 in. may be obtained if desired, this limit being possible through light-wave measurement.

Trent Electrically-Heated Calibration Tank

The calibration tank illustrated has been added to the line of electrical devices manufactured by Harold E. Trent, 259 North Lawrence St., Philadelphia, Pa. The tank, which is used for the calibration of thermometers up to 600 deg.



Trent Electrically-Heated Calibration Tank

F., is made with a copper shell that is filled with oil. For higher temperatures a steel shell is substituted, and salt used for the heating medium.

The body of the device is made of sheet steel, enameled and properly insulated. The tank and flange can be removed independently of the heating units that are spaced around the outside of the tank. The heating units consist of metal strips equally spaced and connected in pairs. The switches control two sets of units each and are interconnected with magnet switches.

When the current is turned on and the thermostat is at its lowest position one of the switches automatically closes. All switches are set for full heat and when the oil reaches a definite temperature the control switches open their respective circuits. As the temperature falls, one of the switches closes and maintains a constant temperature. The tanks are constructed so that they may be mounted in series and used in banks of eight, being held at a definite temperature by a thermostat.

News of the Week

Supreme Court Upholds Purpose and Intent of Trade Association Statistics

Decision meets with approval of business men everywhere

A sweeping decision clarifying the legal view of trade association activities in gathering and distributing statistics was handed down by the United States Supreme Court on June 1, when decrees of lower courts—enjoining the Maple Flooring Manufacturers' Association and the Cement Manufacturers' Protective Association under the Sherman anti-trust law—were reversed.

The decision was by a divided court, six to three. The majority opinion was delivered by Justice Stone, the newest member of the court, who, as attorney general, had given considerable study to the question of trade statistics at the request of the Department of Commerce. Justice McReynolds entered a vigorous dissent in each of the two cases on the ground that the tendency of the activities complained of by the Government clearly was to enrich the members of the associations by controlling production or prices, or both, to the detriment of the consumer. Chief Justice Taft and Justice Sanford dissented in each case on the ground that the evidence brought these cases within the rule laid down by the court previously in decisions sustaining decrees against the American Column and Lumber Co. and the American Linseed Oil Co. The majority opinion, however, holds that in these previous cases clear intent to evade the law was established, while in the cases at issue now circumstances were different.

A Specific Case

The principal decision was read in connection with the decree issued by the District Court in Michigan against the Maple Flooring Manufacturers' Association. The association operates principally in Michigan, Minnesota and Wisconsin. Members of the association represent 70 per cent of the production. The association gathered and distributed statistics of production, stocks, unfilled orders and average sales prices; it published a book giving railroad rates from Cadillac, Mich., to some 1,000 points in the country, and members held meetings where statistics and other matters were discussed. These things in themselves do not constitute restraint of trade, the majority opinion holds.

The Cement Manufacturers' Protective Association operated along similar lines of gathering and distributing information. In addition, in this case the question of distributing information regarding specific job contracts was involved. The Government sued in the District Court of Southern New York for an injunction, alleging violation of the Sherman Law, and was given a decree. Justice Stone, for the majority of the Supreme Court, predicated his opinion in the cement case on that in the flooring manufacturers case, adding that information regarding specific job contracts was not violative of the law because it had not been established that contractors suffered, but merely that the system protected manufacturers against contractors who might take advantage of such contracts for cement if the market was favorable. In this case, the association, four individuals and 19 corporations producing Portland cement and operating principally in Pennsylvania, New Jersey, New York, Maryland and Virginia were involved.

The Majority Opinion

After reciting the history of the case, the majority opinion in the flooring manufacturers association case lays down broad principles as follows:

"It is not, we think, open to question that the dissemination of pertinent information concerning any trade or business tends to stabilize that trade or business and to produce uniformity of price and trade practice. Exchange of price quotations of market commodities tends to produce uniformity of prices in the markets of the world. Knowledge of the supplies of available merchandise tends to prevent overproduction and to avoid the economic disturbances produced by business crises resulting from over-production. But the natural effect of the acquisition of wider and more scientific knowledge of business conditions in the minds of the individuals engaged in commerce and its consequent effect in stabilizing production and price can hardly be deemed a restraint of commerce or if so it cannot, we think, be said to be an unreasonable restraint, or in any respect unlawful.

"It is the consensus of opinion of economists and of many of the most important agencies of Government that the public interest is served by the gathering and dissemination, in the widest possible manner, of information with respect to the production and distribution, cost and prices of actual sales, of market commodities because the making available of such information tends to stabilize trade and industry, to produce fairer price levels and to avoid the waste which inevitably attends the unintelligent conduct of economic enterprise. Free competition means a free and open market among both buyers and sellers for the sale and distribution of commodities. . . . Restraint upon free competition begins when improper use is made of information through any concerted action which operates to restrain the freedom of action of those who buy and sell.

"It was not the purpose or the intent of the Sherman anti-trust law to inhibit the intelligent conduct of business operations, nor do we conceive that its purpose was to suppress such influences as might effect the operations of interstate commerce. . . . Persons who unite in gathering and disseminating information in trade journals and statistical reports on industry; who gather and publish statistics as to the amount of production of commodities in interstate commerce and who report market prices are not engaged in unlawful conspiracies in restraint of trade merely because the ultimate result of their efforts may be to stabilize prices or limit production through a better understanding of economic laws and a more general ability to conform to them, for the simple reason that the Sherman law neither repeals economic laws nor prohibits the gathering and dissemination of information.

Not Conspiracy

"We do not conceive that the members of trade associations become conspirators merely because they gather and disseminate information . . . bearing on the business in which they are engaged and make use of it in their individual businesses.

"Viewed in this light, can it be said in the present case, that the character of the information gathered by the defendants, or the use which is being made of it, leads to any necessary inference that the defendants either have made or will make any different or other use of it than would normally be made if like statistics were published in a trade journal or were published by the Department of Commerce, to which all the gathered statistics are made available?

"We decide only that trade associations or combinations of persons or corporations which openly and fairly gather and disseminate information as to the cost of their product, the volume of production, the actual price which the product has brought in past transactions, stocks of merchandise on hand, approximate cost of transportation from the principle point of shipment to the points of consumption, as did these defendants, and who, as they did, meet and discuss such information and statistics without, however, reaching or attempting to reach any agreement or any concerted action with respect to prices or production or restraining competition, do not thereby engage in unlawful restraint of commerce."

Cost of Production Not a Trade Secret

All government bureaus which make use of confidential figures furnished by industry fear that recent court decisions will discourage the volume of figures being submitted voluntarily. Both the Supreme Court of the District of Columbia and the Court of Appeals have held in connection with Tariff Commission investigations that cost of production is not a trade secret.

Since the war the government bureaus have been getting a much smaller percentage of returns on all questionnaires. This is recognized as being the natural reaction from the flood of questionnaires sent out during the war. More recently, however, a decided disinclination to submit figures has developed. The Bureau of the Census which depends to a considerable extent on voluntary figures is finding it much more difficult to secure a sufficient percentage of returns to give accurate ideas of trends.

Most government agencies engaged in statistical activities find it more satisfactory to get figures on a voluntary basis and they fear that the refusal or indifference of industry in complying with these requests will result in legislation increasing the scope of the returns which now are compulsory.

United States Leads in Consumption of Non-Ferrous Metals

Consumption of non-ferrous metals in this country continues to increase. The margin between the proportion consumed in this country and that of consumption in other countries also grows broader. This is thought to be due largely to the expansion of machinery manufacture in this country. Since the greater bulk of most industrial machinery is of ferrous materials, the public loses sight of the fact that large quantities of non-ferrous metals also are used.

As was pointed out recently by the chairman of the board of the British Metal Corporation, both production and consumption of non-ferrous metals reached new high levels during 1923, and new high levels were established in 1924. He presented the following comparative figures:

	Average of 1911-13	Average of 1921-24	Estimated
Production:			
Copper	100	94	139
Lead	100	88	108
Tin	100	98	108
Spelter	100	75	102
Consumption:			
Copper	100	94	132
Lead	100	81	106
Tin	100	93	112
Spelter	100	76	104

There was a distinct improvement in the European demand, he said, but the disparity between conditions in Europe and in the United States of America is still very marked.

Taking the pre-war figures—that is to say, the annual average 1911-1913—as a basis, the United States consumed during 1924, 116 per cent more copper, 42 per cent more lead, 34 per cent more tin, and 49 per cent more spelter.

During the same period all other countries together consumed during the year 1924, 10 per cent less copper, 12 per cent less lead, 2 per cent less tin, and 15 per cent less spelter.

An equally striking contrast appears in a recent statement by an American authority of the per capita consumption of copper in pre-war years and in 1923:

	Average 1912-14 Lb.	1923 Lb.
Great Britain	7.25	4.35
Germany	7.03	3.47
France	5.34	6.61
United States	5.49	12.69

This is causing no little apprehension in England and Germany, according to reports reaching Washington. Just after the war machinery manufacturers in those countries expected to be able to drive American machinery out of world markets. They had the advantage of much lower costs of production and had had more experience in foreign trade. Instead of pre-empting the business as they expected, the proportion of American machinery sold in world markets has increased at a steadily accelerated rate. Instead of reducing the pre-war machinery sold abroad the foreign manufacturers now are wondering what proportion of their pre-war volume of business they will be able to save. A striking fact in connection with the increasing demand for American machinery is the fact that it depends on the excellence of the product for its popularity. The machinery with which it competes sells at lower prices.

Erratum

An error was made in reporting the remarks of W. H. Rastall of the Bureau of Foreign and Domestic Commerce before the National Machine Tool Builders' Association at Buffalo. On page 792c the statement is credited to Mr. Rastall that $50,000,000 worth of metal-working machinery has been absorbed by British India since the Armistice. The statement should read "more than $13,000,000."

Argentine Buys More American Machinery

In view of the rather depressed state of business in Argentine during 1924, the decided upturn in the amount of American machinery taken by that country is looked upon as an encouraging indication. Exports of industrial machinery destined to points in Argentina were valued at $5,056,139 for the calendar year of 1924. In 1923 the total of these exports was $3,874,848. In 1922 we sent the Argentine $3,583,125 worth of machinery. The 1924 exports were sub-divided as follows: textile, sewing and shoe machinery, $725,449; mining, oil well and pumping machinery, $767,101; power-generating machinery, except electric, $893,270; construction and conveying machinery, $500,822; metal-working machinery, $214,889; miscellaneous other machinery, except agricultural machinery, $1,942,608.

Southern Pacific to Buy Large Order

The Southern Pacific Co. has applied to the Interstate Commerce Commission for authority to issue equipment trust certificates so as to purchase some $15,000,000 worth of equipment as follows: Fifteen 3-cylinder 4-10-2 type locomotives and tenders; 18 Mountain type locomotives and tenders; 10 switching 0-6-0 type locomotives and tenders; 2,796 steel underframe box cars; 200 automobile cars; 1,000 steel drop-bottom gondola cars; 200 steel oil tank cars; 400 steel selective ballast cars; 50 caboose cars; 200 steel underframe caboose cars; 6 steel baggage and postal cars; 6 steel baggage horse cars; 6 steel suburban electric motor coaches; one steel dynamometer car; one rotary snow plow; one 50-ton steam operated locomotive crane; one 25-ton steam operated locomotive crane; one industrial No. 3 pile driver; two industrial No. 4 pile drivers; three 50-ton Jordan spreaders.

J. M. Davis to Head Lackawanna

William H. Truesdale, for the last twenty-seven years executive head of the Delaware, Lackawanna & Western Railroad, has resigned.

He will be succeeded by John Marcus Davis, president of the firm of Manning, Maxwell & Moore, Inc., of New York, a railroad man of wide and varied experience.

Mr. Davis began his railroad career as a freight brakeman on the San Antonio & Arkansas Pass. He has served as stenographer to the superintendent of the Gulf, Colorado & Santa Fe; chief clerk to the superintendent of the Mexican Central, in the general manager's office of the Great Northern, and later as assistant superintendent.

In 1898 he was appointed superintendent of the Breckinridge and Montana divisions of the Great Northern, and in 1900 he went to the Erie Railroad as superintendent at Scranton, Pa.

In 1914 he became general manager of the Baltimore & Ohio Southwestern-Cincinnati, Hamilton & Dayton lines, Later, as vice-president in charge of operations, he supervised all of the railroad's properties.

Mr. Davis will resign as president of Manning, Maxwell & Moore, Inc., but will probably continue on the board of directors of the firm.

Exhibit in Mexico

The Sociedad Jalisciense Impulsora of Guadalajara, Jal., Mexico, of which Gov. Zuno is the head, is inaugurating an exhibition hall for the purpose of displaying tools and mechanical appliances useful in that section of the country.

The engineers and workers in this locality are interested in metal and woodworking, as well as in mining.

Samples can be sent by parcel post and descriptive matter by regular mail. Both will be welcomed by the members of the society, and will be duly acknowledge by the secretary.

Albert J. Jones Dead

Albert J. Jones, secretary and general manager of the Acme Machine Tool Co., of Cincinnati, died suddenly on May 30. Mr. Jones had a long and interesting career in the machinery and allied industries and was one of the best known executives in the trade.

Albert J. Jones

He started his association with machine tools with the Lodge & Shipley Machine Tool Co., where he remained for six years. He joined the Acme Machine Tool Co. in 1912, and rose rapidly to the position of secretary and manager, positions he was filling ably at the time of his death. Besides this work, Mr. Jones was manager of the Champion Tool Works.

W. L. Bean Appointed Mechanical Manager

Announcement has been made of the appointment of W. L. Bean as mechanical manager of the New York, New Haven & Hartford Railroad Co., to succeed L. N. Reed, who resigned.

Mr. Bean came to the New Haven road during the year 1916, as assistant to the president in investigating property and in formulating the report and recommendations for the improvement. Mr. Bean covered matters relating to mechanical department facilities, new power, etc. It was largely in accordance with his recommendations and plans that a number of improvements were carried out.

In September, 1917, Mr. Bean was made assistant general mechanical superintendent, and on Nov. 1, 1918 mechanical assistant to the president, acting in that capacity until Dec. 1, 1923, at which time he was made assistant mechanical manager.

Mr. Bean is a member of the American Society of Mechanical Engineers, and the Society of Automotive Engineers.

Business Items

The American Grinder Manufacturing Co., 148 Broadway, Milwaukee, Wis., has changed its name to the Blackhawk Manufacturing Co. For several years the concern has been specializing in the manufacture of tool kits or sets for the automotive trade, and these instruments have been trade marked "Blackhawk." The development of this business has resulted in the change of name to conform with the bulk of the present production.

R. S. Armstrong & Brothers Co., of Atlanta, distributor in the Southeastern territory of contractors' equipment, announces that this company has been recently appointed distributor in this teritory of the Jaeger line of concrete mixing machinery.

Manufacture of steam engines, throttle valves, etc., will begin shortly at the new plant of the Pekor Iron Works, including foundry and machine shops, now being established at Columbus, Ga. Equipment includes installations for a boring mill, lathes, slotters, etc., in the shops, all of which has already been purchased.

One of the year's most important announcements in Detroit's industrial field is that of the organization of the Detroit Aluminum and Brass Corporation. J. P. Carritte is president and treasurer. Mr. Carritte organized and for years operated the McAdamite Aluminum Co. and was also a director of the General Aluminum and Brass Manufacturing Co. L. G. Hooker is vice-president and secretary of the new company. For twelve years he was treasurer and a director of the General Aluminum and Brass Manufacturing Co.

The aluminum and brass foundries will be under the management of Philip J. Fobert, production manager of the bearing division; Paul Coskey, in charge of babbitting operations; Wm. M. Cooper, chief engineer; and J. P. Carritte, Jr., who will act as assistant foundry superintendent and metallurgist.

The Industrial Works, of Bay City, Mich., manufacturers of locomotive cranes and crane equipment, announces the recent opening in the Hurt Bldg., Atlanta, of a district office to handle the company's trade in the Southeastern territory. John J. Murphy has been appointed manager of this office.

The Joyce-Koebel Diamond Co., of New York, importer of industrial diamonds, has announced the appointment of J. K. Murray and E. D. Rummins as representatives in the Detroit market district. Offices have been established at 4724 Hastings St., in Detroit.

It is also announced that J. W. Horne has been appointed sales representative in Wisconsin, Iowa, Illinois and Minnesota, with headquarters at 560 Washington Bldg., Chicago.

The employees of the E. B. Yates Machinery Company, manufacturers of woodworking machinery, have purchased the business. E. L. Hart, Chicago district manager, is one of the new owners. F. G. Farrow, formerly of Chicago, is another. He will continue as manager of the Beloit factory. George W. Robinson, Hamilton, Canada, branch manager; B. F. Bader, San Francisco branch office manager, and W. H. Payne, Portland, Ore., branch manager, are the other buyers. Plans are being perfected to include Yates employees in the ownership in the near future.

The Rivet Lathe and Grinder Corporation, of Boston, Mass., announces the change of its Detroit office from Cass Ave. to Room 3-245, General Motors Bldg. T. C. McDonald is in charge.

F. A. Hunter Succeeds Brother

At a recent meeting of the directors of the Hunter Saw and Machine Co., of Pittsburgh, Frank A. Hunter, who has been treasurer and sales manager of the organization, was elected president

Frank A. Hunter

and general manager to succeed his brother, the late Harry S. Hunter.

Joseph Kennedy continues as vice-president, R. E. Vaughn was elected treasurer, and Frank A. Hunter, Jr., was elected a director.

Frank A. Hunter was one of the organizers of the Hunter Saw and Machine Co. He was a pioneer in the designing of circular metal cutting saws and hardened steel specialties, on which he holds many patents. Mr. Hunter will continue the policies of the previous management.

American Blower Convention

The twenty-fifth annual sales convention of the representatives of the American Blower Co., of Detroit, Mich., was held April 24 and 25. The two days were divided between Cincinnati and French Lick, Ind., and one of the best sessions of this organization was reported after the conclusion of the program. Sixty members of the sales force attended.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By Theodore H. Price
Editor, *Commerce and Finance, New York*

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LOOKING seaward from the bridge of the American ship Business one can almost hear the watch in the bow chant the seamen's refrain, "Eight bells and all's well," as the vessel proceeds smoothly on her course.

The outlook is indeed reassuring, for there is hardly a cloud in sight and the sea is almost unruffled by the summer breeze. In such a situation the only service that an interpreter of the news can perform is to point out that a storm always succeeds a calm and to indicate the quarter from which the bad weather is likely to come.

But to be a prophet of disturbance in a time of tranquility is always a thankless and sometimes an unnecessary task, especially when, as now, there is so little that foreshadows trouble in any direction. The markets that are not under artificial control are acting normally.

On the Stock Exchange the professional speculators are still piping to the public but their music seems to fall on deaf ears and their invitations to the dance are as yet unheeded. From day to day first one and then another group of securities are marked up, but outside buying has not been attracted and the stock brokers are commencing to complain of the speculative apathy. Some attribute it to the advance in commissions which went into effect about a year ago, but a more plausible explanation is that the losses of last February and March are not yet forgotten.

Then there is the increase in the number of speculative securities. The business in the so-called Curb Market has grown enormously and there are many issues bought and sold on margin that are only traded in over the counter or by telephone. This statement is particularly applicable to the stocks and bonds of so-called public service corporations that manufacture or distribute gas, electric light and power.

Although it is not featured by newspaper scare heads, the demand for such securities has been enormous, amounting to almost a mania in some cases.

In a recently published statement, H. C. Abell, president of the American Gas Association, is quoted as saying that "The American people during the first four months of 1925 invested their savings in the securities of public service companies at the almost unbelievable rate of $5,000,00 a day, $212,000 an hour, or $3,500 a minute, Sundays and holidays included." Mr. Abell adds that "this record is perhaps the most remarkable in the history of corporate financing."

Mr. Abell concludes, "In other words, for the brief period of twenty-eight months ending April 30, 1925 the huge sum of $2,800,000,000 was invested in all branches of the public service industry by the thrifty men and women of America. As these words are being read the people are buying our securities at the rate of $60 a second, and the latest available statistics show that the public utility industry has about 5,200,000 security holders, divided about equally between stock and bond holders."

These figures are certainly amazing. They must be gratifying to the officers and bankers who have financed the public utility companies, but money that comes easily sometimes goes easily, and to the conservative investor Mr. Abell's statement will suggest the wisdom of great circumspection in determining whether his public utility securities are worth what they can now be sold for.

This is not intended to disparage the public service industry or the genius of its leaders. It is simply a counsel of caution to the many who are prone to become the victims of their own enthusiasm in times of speculative excitement.

Other features of the week's news that call for brief comment include a decline in francs to 4.89 cents, a credit of $50,000,000 arranged by Italy for use in stabilizing the Italian lira and the fight over the reorganization of the Chicago, Milwaukee & St. Paul Railroad that seems to be developing. The weakness in francs is due to the apparent increase in the currency notes issued by the Bank of France. In effect the internal debt now maturing is being met by an increased issue of paper money. There can be only one end to this procedure unless it is checked. The St. Paul fight is interesting.

The commercial markets have not been sensational. The retail trade seems to be on the mend, the chain stores and the mail order concerns all report increased sales, and some gain in distribution is admitted by the wholesalers and jobbers. The automobile companies say their sales are increasing and the other metal industries are about in *statu quo*.

A cable from London says that the Australian wool growers will try to establish a selling organization to control prices. If the attempt is made the effect probably will be a stagnant market and eventually a collapse. The ultimate consumer is getting tired of being held up by combinations that seek to stifle competition and control prices. It is this vain effort to maintain or advance values that stands in the way of the increased consumption that is essential to real prosperity.

When it is abandoned and things are allowed to seek their natural level the talk of over-production will be at an end and we will get a revival in business that will put every man at work and start up the machinery of every factory in the land. Managed markets are a legacy of the war and not until they are abandoned will we get back to prewar consumption and production.

What's Doing in Industry

Business faces a most reassuring state of affairs at the beginning of the last month in the fiscal year. There is little if anything that might forecast business trouble. Markets that are not under artificial control have assumed a firm and normal attitude and financial circles are highly optimistic over the outlook for the future.

In our own industry things have begun to look brighter. The industrial world is busy. General manufacturing and construction work continues at a high level, and the automotive field is working to capacity on advanced schedules.

The Mid-West seems to present the best market for machine tools and equipment. In the great industrial centers in that territory machinery has been in steady demand during one of the best production seasons in several years.

In the Southern territory the activity of the textile and general construction trades has stimulated a demand for machinery that has been quite encouraging. In the East the demand has been confined to scattered orders from various sources.

Early reports to the Department of Commerce in May show declines in principle indicators from the previous month, but prices of stocks averaged higher than in April. Compared with May, 1924, these same indicators increased and trade and financial items were generally higher than a year ago. Decreases from a year ago occurred in the number of business failures, commercial paper interests, the public debt and government expenses.

The Industrial Review

Progress of the machinery and machine-tool business in various parts of the country

THE following reports gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

Philadelphia

Business in most industrial lines in Philadelphia continued on the up-grade during the month just ended. There has been some machine tool buying by Eastern railroads and the news from the West that the Union Pacific system has prepared a list of machinery and machine tool needs which may mean the expenditure of upward of $400,000 was received with considerable interest.

Some of the industries are operating as high as 65 per cent of capacity, but several are running below that figure. The railroads are buying tools and shop equipment to meet their current needs, and the recent retrenchment policy of the Pennsylvania Railroad Co. indicated to many of the manufacturers that nothing large in the way of machine tool orders may be expected now.

A majority of the larger manufacturers in general industrial lines report orders ahead to keep them busy until the middle of July. In the meantime they hope to have sufficient more to keep up their present rate of production during the Summer.

Dealers in used tools report a fairly active business, and hope for increased orders was expressed from many of the smaller manufacturers.

New York

The local district has developed into a buyers' market. This sums up in few words the situation as it appears after a survey of current business. Conditions are not up to the desires of local dealers, but they are nevertheless up to expectations for this time of the year. Buyers are taking what they want, when they want it. They are not being sold.

New orders are not plentiful but to those who have consistently and persistently sought business there has come a satisfactory volume of trade. The industrial market, operating on a fuller schedule than others, has been the best customer of machine tool manufacturers and dealers. This market is so extensive and its needs are so diversified that there is always need for more equipment. The only difficulty experienced in filling orders for general manufacturers is the fact that nearly all orders from this source are for special machines bought to lessen labor cost and increase production. This means a greater overhead for machine tool manufacturers because of a miscellaneous production schedule. However, this business is highly regarded by all concerns.

To that class of manufacturers who serve the railroad interests has come little new business. One fair sized order was received by a local manufacturer for five machines for the repair shops of the Union Pacific. Other orders, scattered around in the market are for small tools and miscellaneous equipment.

The automotive market is still an active customer for tools and special equipment. The Ford Motor Co. last week purchased a 200-ton wheel press and other companies bought machinery, sparingly, of course.

The foreign market continues to grow, Russia proving a steady buyer of American machinery. As was mentioned before in this column, our manufacturers are welcome to the greater share of this business just as soon as they become convinced of the stability of the industrial market. The one thing that Russia needs today is long term credits, and the few manufacturers who have been willing to grant these have received orders of a substantial character. Germany and England are quick to grasp this business on any terms.

Southern District

Though machine tool and equipment sales in the Southern district are still fairly active to the textile, lumber, furniture and similar industries because of active industrial conditions, business as a whole appears to have fallen off a little of late, distributors reporting their sales fair to quiet.

From automobile service stations there is an active demand for rebuilt tools and machinery, as this branch of the industry is constructing this year on a basis of 15 to 20 per cent greater than any previous year. But in other markets the demand is light. Machine shops are buying comparatively little at this time with the possible exception of the pipe-making shops in the Alabama district where sales are fair, this including both new and rebuilt equipment.

Railroads continue fairly active buyers of heavier equipment. However, sufficient shop construction is in progress in the Southern states by the larger railroads to give promise of better business through the summer months, present indications portending a slight increase over 1924.

The market that is particularly active at this time is in the textile trade. Machinery sales to contractors also are fairly active, including mixers, cranes, and similar equipment. The outlook to this source is very good as all indications at present seem to forecast a record building year in the Southern states.

Road construction is active in all the Southern states this year, and distributors continue to report a fair volume of business in road building machinery. Sales to this source the first half of 1925 undoubtedly will be the largest they have even been for this period before.

It is interesting to note that new industrial construction in the South the first six months of 1925 will exceed by 15 to 20 per cent the previous largest record for this period, and that a good share of the machinery and tool business so far has been to this source.

Cincinnati

A slight increase in demand during the past week is reported by Cincinnati machine tool concerns, including both the manufacturers and the dealers. Closing of books shows that May sales were better than those of April, and judging from the way in which June has opened it is freely predicted that it will be better than May.

While it is anticipated that business will be somewhat dull in the summer months, there is a general opinion that conditions are much more favorable this year than they were last, and therefore there will be no abnormal decrease during the heated season, and conditions will be entirely normal.

There are a greater number of firms inquiring than there are buying, but the discrepancy between inquiries and sales is decreasing and a greater percentage of the quotations given out are resulting in orders. The general experience is that the demand is about equal in all sections, and there is no tendency toward localization of orders and prospective buyers.

The automotive industries are still buying freely, despite the fact that their usual season for purchasing machine tools has closed. Some export orders for Europe have been reported, and also some for South America. There has also been a good-sized shipment to the Pacific Coast.

The increased demand is for all kinds of machine tools, large and small, is coming from various kinds of industries, as well as from various sections, and all tendency toward "spottiness" is slowly disappearing. One company reported that its May business was twice as large as April business, and that it received twice as many orders the first few days of this month as it did in the same period of the previous month.

Detroit

Five months of the first half of the year 1925 have rolled away and June begins with motor car production at the highest point in the history of the automobile industry, a circumstance which is maintaining the sales of machinery and machine tools at a high level in Detroit and southeastern Michigan.

A normal and consistent increase in the output of the different plants has brought the automotive industry to

this record position without any undue excitement being provoked, and with a large portion of the public still unaware of the demand for cars.

The feature in the machinery field is the extension of the Wilson Foundry and Machine Co's. plant at Pontiac, Mich., where some two millions of dollars are being expended for new buildings and machinery. All equipment and machinery will be installed by October.

Additional machinery will be purchased by the Flint Motor Co. to care for the manufacture of Mason trucks. The manufacture of Masons, heretofore carried on in a separate plant at Flint, will be moved to the main plant.

Lansing distributors of farm machinery are reporting heavy demands throughout central Michigan for all such equipment.

Chicago

With the exception of additional inquiries from the C. M. & St. P. R. R., which brings the receiver's allotment for the machine tool requirements of that road within hailing distance of the sum set apart for machinery equipment, there is no material change in the local machine tool situation.

Present inquiries are mainly for tools for replacement and such little buying as there is contemplates the use of used instead of new machinery where the former can be used to advantage.

The new inquiries of the C. M. & St. P. include the following: Three double emery grinders, motor-driven, twelve-inch wheel; one 1,500 lb. steel hammer; one 48-in. punch and shear, capacity one inch through one inch, motor-driven; one power hack saw; one 3,000-pound electric crane truck; one double-head bolt cutter, motor-driven; one driver drop pit table; one 90-inch back-geared driving wheel lathe with quartering attachment for both head and journal turning attachment; one 18-in.x8-ft. engine lathe, geared head, compound rest taper attachment, motor-driven; one 24-in.x12 ft. engine lathe, geared head, compound rest, taper attachment, motor-driven; one 36-in.x18-ft. engine lathe, geared boring mill, motor-driven; one 2-in. turret lathe; one 72-in. radial drill press, motor-driven; one 42-in. vertical drill press, motor-driven; one 20-in. stationary-head upright drill press.

Milwaukee

One of the most encouraging signs that has been noticeable in the machinery business since the war-time period is that a slight recession in the demand from the automobile industry has not been followed by a general let-down. Other industries keep up the volume, and so far in June the volume of sales has been fairly well maintained.

In some local tool manufacturing shops, more than 50 per cent of the orders on the books consist of special jobs, or custom work being executed to specifications of customers. In other words, less than one-half of the orders are for the standard designs contained in the catalogs of the tool builders.

The middle of June finds the machine tool trade in about the same position as it was a month ago, so far as the actual volume of business on the books is concerned. The actual prospect, however, is improved. The belief locally is that the last half of 1925 will witness greater productive activity than the first half, owing largely to the tendency of users to replace standard types of tools with the most advanced designs, all for the sake of producing more materials, and a greater variety, with the least possile capacity.

New England

Special machinery builders have been favored more than the manufacturers of standard products in the present volume of business, judging from the expression of manufacturers in the New England territory. The first five months of this year indicate improvement of business over the corresponding period of 1924 that ranges from 10 to 20 per cent higher. In some lines the usual seasonal decline is observed but the curve does not dip as far as a year ago, and the inquiries are satisfactory. Consensus of the sales managers is that the business for the first three months was, in some instances, as much as 40 per cent better than the first quarter in 1924.

Among the standard machine builders the attitude taken is that business shows a tendency to slacken. Buying for the automotive trade has been well maintained. Prospective export business with France has dropped off due, undoubtedly, to the money situation and the dubious political future.

Contract manufacturers engaged in production for the automobile trade state that there is a disposition to increase orders, rather than to curtail, and schedules suggest the continuance of a satisfactory business. Hand tool manufacturers report a fair amount of trade and nothing more than seasonal falling off is expected.

American Machine Tools Most Popular in Great Britain

An important feature of the machine tool situation in Great Britain at the end of the first quarter of 1925 was the extent to which the sales of American machine tools continued, even when the sale of other makes declined, according to H. D. Butler, commercial attaché in London. Sales of British and foreign machine tools were between 10 and 20 per cent less than in the last quarter of 1924, while American sales were about equal in volume. This is a return to the situation in pre-war years, when American tools held a more important place in the British market than they have since the war.

The main cause for the relative improvement in the American position is the increased activity of the automotive industry and the resultant demand for American metal-working machinery. About 50 per cent of the machine tools used in the automotive industry are of American manufacture. On the other hand, the depressed condition of the shipbuilding industry has caused a decreased demand for the heavy engineering apparatus usually supplied by the domestic tool-building industry.

There are about 40 or 50 British makers of machine tools with an aggregate output valued between £5,000,000 and £6,000,000 per annum.

Personals

GUNNER R. LUNDANE, formerly manager of the New York office of the Black & Decker Manufacturing Co., has resigned to join the United States Electrical Tool Co., of Cincinnati, Ohio. Mr. Lundane will act as special Eastern representative and will make his headquarters at the New York office of the United States Electrical Tool Co. at 50 Church St., New York City.

A. J. BRANDT has been appointed works manager of the Oakland Motor Car Co., according to an announcement made by A. R. Glancy, president and general manager of the company. Mr. Brandt is a mechanical engineer, a graduate of Case Scientific School, and has been associated with Mr. Glancy for ten years.

CARROLL J. ROGERS has been appointed chief supervisor for the Willys-Overland Co., a new position in a department which has just been organized.

C. P. GOREE, JR., according to announcement by the Frick Co., of Waynesboro, Pa., has been named manager of the Atlanta district office, succeeding A. M. Hutchinson. The Atlanta district comprises George, Florida, Alabama and eastern Tennessee. The Frick company manufactures refrigerating machinery.

FRANCIS HODGKINSON, chief engineer of the Westinghouse Electric & Manufacturing Co.'s plant at South Philadelphia, has been awarded the Elliot Cresson medal by Franklin Institute for his work in design and construction of steam turbines.

FRANK B. DRAKE of the Johnson Gear Co., has been elected chairman of the Golden Gate Chapter of the American Society for Steel Treating.

LOUIS W. GROVE, treasurer of the Cleveland Pneumatic Tool Co., of Cleveland, has been elected Mayor of the newly formed municipality of Menter Village, Ohio.

A. L. HUMPHREY has been elected a director of the American Brake Shoe and Foundry Co. Mr. Humphrey is president of the Westinghouse Air Brake Co.

F. L. KOHLHASE, of the National Stamping and Electrical Works, Chicago, is the new president of the Chicago Machinery Club.

D. S. EDDINS, former assistant sales manager of the Chevrolet Motor Co., has resigned that position to become sales manager for the Olds Motor Works, succeeding G. H. Peasley.

WARREN G. HOAGLAND, of Detroit, has resigned as chief of the specialties division of the Bureau of Foreign and

Domestic Commerce. He will become associated with L. C. Smith & Bros., of Syracuse, as manager of foreign sales.

DR. JULIUS KLEIN, chief of the Bureau of Foreign and Domestic Commerce, sailed for Europe on June 10. He will spend several months inspecting the bureau's offices in various countries.

NATHAN HEROLD has been appointed manager of the U. S. Tool Co., at Cranford, N. J.

GANO CAYWOOD has been appointed New England representative for the Utica Compressor Co., Inc.

DAVID F. EDWARDS has been elected president of the Wickwire Spencer Steel Co., succeeding T. H. Wickwire, resigned.

IRA D. GROVE has resigned as sales manager for the Lees-Bradner Co., of Cleveland, manufacturer of machine tools. He has not announced his plans for the future.

H. J. DAVIS has been appointed general manager of the Cleveland Armature Works, manufacturers of grinding and buffing machines.

WILLIAM H. AHLERS, vice-president of the Buffalo Hoist and Device Co., Buffalo, N. Y., has been elected chairman of the Buffalo Section of the A.S.M.E.

E. A. RINGWALD has become designing engineer for the American Rolling Mills Co., Ashland, Ky. He was formerly associated with the Athens Foundry and Machine Works, at Lancaster, Ohio.

SIDNEY THOMPSON, president of the Defiance Screw Machine Products Co., Defiance, Ohio, was selected to head the newly organized Steel Cross Arm and Cable Equipment Co.

LOUIS G. HENES has been appointed representative of the Fellows Gear Shaper Co. In a previous announcement of this appointment we stated that Mr. Henes was located at 218 E. Third St., San Francisco. This is an error. The Henes offices are at 75 Fremont St., San Francisco, and at 218 E. Third St., in Los Angeles.

G. E. SANDERSON has been appointed manager of the Syracuse office of the Wagner Electric Corporation. His office will be located at 415 Seitz Bldg., in Syracuse.

SAMUEL INSULL, of Chicago, has been elected president of the National Museum of Engineering and Industry.

L. R. MEISENHELTER, of Philadelphia, will take charge of the assembling of the machinery, transportation and manufacturing exhibits at the Sesquicentennial celebration in Philadelphia next year.

COLONEL H. C. SMITHER, chief coordinator for the Federal Government, will assume the rank of Brigadier General on June 18.

HENRY F. RUSSELL, formerly of the Lumen Bearing Co., has been appointed sales manager for the Sumet Corporation and Cored Bar Corporation, of Buffalo, N. Y.

Trade Catalogs

Ryan Mires. F. J. Ryan & Co., Philadelphia, Pa. A four-page bulletin, Series S-4, describing a new low-pressure oil burner manufactured by this company. The construction and operation of this equipment is explained by text and illustrations.

Lokseam Safety Guards. Charles J. Dickgiesser & Co., Derby, Conn. A circular describing a new line of safety guards for machinery. These products are said to be oil tight, constructed without welding or riveting and are not affected by vibration. Several types of guards are illustrated attached to various machines.

Diesel Engines. Fulton Iron Works Co., St. Louis, Mo. Bulletin No. 808 giving detailed information regarding the type J Fulton Diesel engine. In addition to listing the engine sizes the bulletin includes diagrams of the machines and tabulates the principle dimensions for these several sizes.

Temperature Curves. Automatic & Electric Furnaces, Ltd., London, England. A second edition of the temperature curves issued some time ago by this company. The charts show temperatures of steel when heated at two different rates.

Milburn Apparatus. The Alexander Milburn Co., Baltimore, Md. Two new miniature catalogs describing the latest improvements in carbide lights for night construction, and welding and cutting apparatus. Complete details of each type of apparatus with illustrations are included.

Blanchard Grinder. The Blanchard Machine Co., Cambridge, Mass. Catalog No. 16, containing complete description and specifications of the new No. 16 Blanchard high power vertical surface grinder. The pages are laid out in very concise style, facing pages having large illustrations of the machine with the text giving the necessary explanatory information. The catalog is enclosed in fine heavy covers and is a very attractive book of reference.

Motors. The General Electric Co., Schenectady, N. Y. "High-Speed Induction Motors and Frequency Changers" is the name of a 27-page bulletin just issued by this company. This booklet, well illustrated by photographs, tables, diagrams, etc., presents a complete line of motors, alternators and frequency changers adaptable for application in modern high-speed machines.

Circuit Breakers and Electrical Instruments. The Roller-Smith Co., New York. Two new bulletins covering two new lines of apparatus manufactured by this company. Bulletin No. 400 covers two lines of small direct-current panel type instruments, Types TD and FD ammeters, milliammeters, voltmeters, milli-voltmeters and volt-ammeters. These instruments employ the d'Arsonval mechanism. The TD and FD instruments are intended particularly for radio sets, battery eliminators, battery chargers, X-Ray apparatus, alarm systems and small panels of all kinds. Supplement to Bulletin No. 530 describes the new non-closable on-overload circuit breaker recently brought out.

Obituaries

CHARLES A. STARBUCK, president of the New York Airbrake Co., died on May 30.

LOUIS J. BITNER, metallurgical engineer with the Jones & Loughlin Steel Corporation, was killed in an automobile accident on May 31, in Pittsburgh.

ANDREW W. FOOTE, retired president of the Foote-Burt Gear Co., and president of the Cleveland branch of the National Metal Trades Association, died on June 3. Mr. Foote was well-known in the machinery industry, and particularly among machine tool builders.

Calendar of Local Meetings

American Society of Mechanical Engineers

Birmingham, Ala. June 16. Inspection of mills. Avondale Cotton Mills.

Philadelphia, Pa. June 16. Joint outing with A. I. E. E.

Atlanta, Ga. June 18. Supper meeting and election of officers.

Denver, Col. June 26. Regular business meeting and election of officers. Excursion to radio stations in Denver.

Portland, Ore., June 22 to 25. Pacific Coast Regional Meeting.

National Association of Cost Accountants

Philadelphia Chapter. June 12. Subject: "Advertising Budget." How it is lined up and operated. Who pays for it?

Western Massachusetts. June 23.

Forthcoming Meetings

National Association of Cost Accountants. Sixth international cost conference, Detroit, Mich., June 15, 16, 17 and 18. Headquarters at Hotel Statler. Secretary, Stuart C. McLeod, 130 West 42nd Street, New York City.

Division V of the American Railway Association. Business meeting June 16 to 18, Chicago. V. R. Hawthorne, 431 S. Dearborn St., Chicago, Ill.

Society of Automotive Engineers. Summer Meeting. Greenbrier Hotel, White Sulphur Springs, W. Va., June 16, 17, 18 and 19. C. F. Clarkson, secretary, 29 West 39th St., New York City.

American Society for Testing Materials. Twenty-eighth annual meeting. Chalfonte-Haddon Hall Hotel, Atlantic City, N. J., June 22, 23, 24, 25 and 26. C. L. Warwick, secretary-treasurer, 1315 Spruce St., Philadelphia, Pa.

National Foreign Trade Council. Annual Convention. Seattle, Wash., June 24, 25 and 26. O. K. Davis, secretary, India House, Hanover Square, New York City.

American Railway Tool Foremen's Association. Annual convention, Hotel Sherman, Chicago, Ill., in August. G. G. Macina, C. M. & St. P. Ry., 1402 Calumet Ave., Chicago, Ill.

International Railway General Foremen's Association. Annual convention, Hotel Sherman, Chicago, Sept. 8, 9, 10 and 11. William Hall, secretary and treasurer, 1061 W. Wabash St., Winona, Minn.

New Haven Branch of the American Society of Mechanical Engineers. Fifth annual machine tool exhibition. Sept. 8 to 11. Mason Laboratory. H. R. Westcott, chairman.

Association of Railway Supply Men. Annual convention and exhibition. Hotel Sherman, Chicago, Sept. 8, 9, 10 and 11. Earl E. Thulin, secretary, the Duff Manufacturing Co., 715 People's Gas Bldg., Chicago.

American Society for Steel Treating. Annual Convention and National Steel Exposition. Public Auditorium, Cleveland, Ohio. Week of Sept. 14. W. H. Eisenman, Secretary, 4600 Prospect Ave., Cleveland, Ohio.

Production Meeting Society of Automotive Engineers. Sept. 14, 15 and 16. In conjunction with American Society for Steel Treating. John Younger, chairman; G. F. Clarkson, secretary, 29 West 39th St., New York City.

Management Week. Conducted jointly by five societies—The American Society of Mechanical Engineers, The American Management Association, The National Association of Cost Accountants, The Taylor Society and the Society of Industrial Engineers. Week of Oct. 19 to 24. W. L. Conrad, of the A. S. M. E., is chairman of the joint committee.

The Weekly Price Guide

Rise and Fall of the Market

Iron and Steel—Pig-iron demand has been slowly gaining momentum during the past two weeks. Maximum on No. 2 f'dry Southern, however, is about $1 per ton below a week ago. Price weakness in steel is most apparent in light rails, wire products and sheets. The three principal hot-rolled products are quoted at $2 to $2.10 per 100 lb., Pittsburgh. Bars are firmest of the three, with plates next and shapes, weakest. Quotations as low as $1.90 per 100 lb. have been mentioned on plates.

Non-Ferrous Materials—Price of electrolytic copper has not fluctuated over ¼c. per lb., one way or the other, during the past seven weeks; between the high and the low quoted thus far this year, there has been a range of 1¾c. Tin is 1¼c. per lb. above the May 29 level in New York warehouses; lead has not changed since then; zinc dropped ¼c. per lb.

(All prices as of June 5)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$23.05
Northern Basic	22.27
Southern Ohio No. 2	22.77
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	27.37
BIRMINGHAM	
No. 2 Foundry	20.00@21.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	23.26
Virginia No. 2	29.17
Basic	22.26
Grey Forge	22.75
CHICAGO	
No. 2 Foundry local	22.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	25.55
PITTSBURGH, including freight charge ($1.76) from Valley	
No. 2 Foundry	22.77
Basic	22.77
Bessemer	22.77

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.75
Cleveland	4.75@5.00
Cincinnati	5.00@7.50
New York	5.00@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	New York	Cleveland	Chicago
No. 10	2.40@2.50	3.89	3.15	3.80
No. 12	2.45@2.55	3.94	3.20	3.85
No. 14	2.50@2.60	3.99	3.20	3.95
No. 16	2.60@2.70	4.09	3.35	4.15
Black				
Nos. 17 to 21	2.95@3.30	4.15	3.95	4.30
Nos. 22 to 24	3.00@3.35	4.20	4.00	4.35
Nos. 25 and 26	3.05@3.40	4.25	4.10	4.40
No. 28	3.15@3.50	4.35	4.15	4.50
Galvanized				
Nos. 10 and 11	3.25@3.60	4.35	...	4.50
Nos. 12 to 14	3.35@3.70	4.45	...	4.60
No. 16	3.50@3.85	4.60	....	....
Nos. 17 to 21	3.65@4.00	4.75	....	4.90
Nos. 22 to 24	3.80@4.15	4.90	4.75	5.05
No. 26	3.95@4.30	5.05	4.90	5.20
No. 28	4.25@4.60	5.35	5.20	5.50

WROUGHT PIPE (Welded)—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	53%	39%	55½%	43½%	59½%	48%
3½ to 6 in. steel lap welded	48%	35%	53½%	40½%	56½%	45%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4%, less 5%; class A, plus 23%. Cast iron, standard sizes, 36% off.

Size, Inches	List Price per Foot	Diameters Inches External	Diameters Inches Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following base discounts are on 20 gauge or .035-in., round, cold-drawn tubing, ⅛-in. to 1-in., O.D., weighing 0.17 lb. to 0.36 lb. per ft. Cutting charge per 100 cuts, $1.50 to $1.58:

O.D. Inches	List Price per ft.	Differential Discount	O.D. Inches	List Price per ft.	Differential Discount
⅛	$0.09	50%	⅞	$0.16	35%
¼	.11	45%	1	.18	31%
¾	.14	40%			

NOTE—The discounts are to be lowered by the following differentials in the case of regular .10-.20 carbon: 25,000 ft. or over, 83; 15,000 to 25,000 ft., 82; 5,000 to 15,000 ft., 81; 1,000 to 5,000 ft., 80; less than 1,000 ft., 79.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.20
Spring steel (light) (base)	7.00	6.00	6.00
Coppered Bessemer rods (base)	6.05	8.00	7.20
Hoop steel	4.49	3.85	4.15
Cold rolled strip steel	6.35	8.25	7.85
Floor plates	5.55	5.60	5.50
Cold drawn shafting or screw	4.15	4.00	3.80
Cold drawn flats, squares	4.65	4.50	4.30
Structural shapes (base)	3.34	3.20	3.10
Soft steel bars (base)	3.24	3.10	3.00
Soft steel bar shapes (base)	3.24	3.11	3.00
Soft steel bands (base)	3.99	3.20	3.65
Tank plates (base)	3.34	3.40	3.10
Bar iron (3.00 at mill)	3.24	3.21	3.00
Drill rod (from list)	60%	55%	50%

Electric welding wire, New York, 3/32, 8.25c.; ⅛, 7.85c.; 5/32 to ¼, 7.35c. per lb. Chicago, 3/32, 8.85c.; 5/32, 7¼c.; ⅛, 7.95c. per lb.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			14.00
Tin, 5-ton lots, New York			57.12½
Lead (up to carlots) E. St. Louis	8.55	New York	9.37½
Zinc (up to carlots) E. St. Louis	6.97½	New York	7.87½

	New York	Cleveland	Chicago
Antimony (Chinese), ton spot	18.00	19.00	.....
Copper sheets, base	21.75	21.75	22.00
Copper wire, base	19.25	16.00	20.00
Copper bars, base	20.87½	20.75	22.50
Copper tubing, base	23.75	24.75	24.00
Brass sheets, base	18.12½	18.62½	18.37½
Brass tubing, base	22.75	25.25	26.00
Brass rods, base	15.87½	16.37½	18.37½
Brass wire, base	18.62½	20.12½	20.00

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminium ingots, 98 to 99%, 1–15 ton lots	28.00	28.00	27.00
Zinc sheets (casks)	11.00	11.25	11.37
Solder (½ and ½), (case lots)	39.50	36.50	.....
Babbitt metal (83% tin)	60.00	65 00	50.00
Babbitt metal (35% tin)	28.00	20.50	28.00
Nickel (ingots) f.o.b. refinery	31.00	.....	.....
Nickel (electrolytic) f.o.b. refinery	38.00	.....	.....
Nickel (shot) f.o.b. refinery	32.00	.....	.....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Hot rolled nickel sheet (base)	52.00
Cold rolled nickel sheet (base)	60.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00
Manganese nickel hot rolled rods "E"—low manganese (base)	54.00
Manganese nickel hot rolled rods "D"—high manganese (base)	57.00

Base price of Monel Metal in cents per lb., f.o.b. Huntington W. Va.:

Shot	32.00	Hot rolled rods (base)	40.00
Blocks	32.00	Cold drawn rods (base)	48.00
Ingots	38.00	Hot rolled sheets (base)	42.00
Cold rolled sheets (base)			50 00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible heavy copper	11.00@11.50	11.25	10.25
Copper, heavy, and wire	10.75@11.00	11.00	10.25
Copper, light, and bottoms	9.25@ 9.75	9.00	9.00
Heavy lead	6.25@ 6 50	6.25	6.50@6.75
Tea lead	5.25@ 5.50	3.75	5.50@5.75
Brass, heavy, yellow	6.75@ 7.25	6.50	7.00
Brass, heavy, red	8.50@ 8.75	8.75	8.00
Brass, light	5.75@ 6 00	5.50	6.00
No. 1 yellow rod turnings	7.25@ 7.50	7.00	7.75
Zinc	4.00@ 4.25	3.50	4.00

TIN PLATES—American Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	14x20	$11.25	$11.45	$11.00
"A" Grade:				
IC,	14x20	8.85	9.40	8 50
	Coke Plates—Primes.			
100-lb.,	14x20	6.50	6.10	6.50
	Terne Plates—Small lots, 8-lb. Coating			
IC,	14x20	7.25	6.95	6.75

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.15@0.22	$0.19	$0.14
Cotton waste, colored, per lb.	.10@ .15½	.18	.09½
Wiping cloths, 13¼x13¼, per lb	.17½	36.00 per M	.11*
Wiping cloths, 13¼x20½, per lb.	....	45.00 per M	.11*
Sal soda, per 100 lb. keg	2.25	2.25	2.00
Roll sulphur, per 100 lb. keg	3.60	3.75	2.85
Linseed oil, per gal., 5 bbl. lots	1.09	1.20	1.23
Lard cutting oil, 25% lard, per gal.	.55	.50	.32
Machine lubricant, medium-bodied (50 gal. wooden bbl.), per gal.	.35	.35	.21
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft. per inch of width for single ply.			
Medium grade	30–10%	30–10%	30–10%
Heavy grade	20–5%	20–5%	20–5%
Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft.			
First grade	50–5%	50–10%	60%
Second grade	50–10–5%	60–5%	65%

*White, at washery.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0324	$0.0349
Cold finished shafting	per lb.	.0415	.0415	.044
Brass rods	per lb	.1587½	.1587½	.145
Solder (½ and ½)	per lb.	.395	.395	.335
Cotton waste	per lb.	.15@.22	.15@.22	14@21
Washers, cast iron (¼ in.)	per 100 lb.	7.00	7.00	6.50
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3 38	3.38	3.38
Lard cutting oil	per gal.	.55	.60	.55
Machine oil	per gal.	.35	.33	.29
Belting, leather, medium	off list	30–10%	30–10%	40–2½%
Machine bolts up to 1x30 in.	off list	40%	40%	50%

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$4.86	$5.84	$5.00
Emery paper	10.71	11.00	11.00
Emery cloth	28.00	31.12	32.75
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.49	1.24	1.50
Cloth	3.38	2.67	3 55
Fire clay, per 100 lb. bag		.65	.75
Coke, prompt furnace, Connellsville	per net ton		3.00@3.25
Coke, prompt foundry, Connellsville	per net ton		3.75@4.25
White lead, dry or in oil	100 lb. kegs	New York, 15.75	
Red lead, dry	100 lb. kegs	New York, 15.75	
Red lead, in oil	100 lb. kegs	New York, 17.25	

SHOP SUPPLIES

Machine bolts, ¼x1½-in., per 100, $1.70. Discount at New York warehouses on all sizes up to 1x30-in., 40%; 1¼ and 1¼x3-in. up to 12-in., 15%; with cold punched hex. nuts up to 1-in. dia. (plus std. extra of 10%) 30%; with hot pressed hex. nuts up to 1x30-in. (plus std. extra of 10%) 35%. Machine bolts, up to 1x30-in., with cold punched and hot-pressed hex. nuts, also button head bolts with hex. nuts are $3.50 per 100 lb. at Cleveland.

Carriage bolts, ¼x1½-in., per 100, $1.00. Discount on all sizes up to 1x30-in., 30%.

Coach and lag screws, 1½x¼in., $2.25 per 100, less 40%.

Tap bolts, 1½x¼-in., $1.00 per 100. List plus 35% at New York warehouses; with hex. heads, $4.65 per 100 lb. net at Chicago.

Bolt ends, 1x12-in., 10c. per lb., less 40%.

Nuts, semi-finished, ¼x¼-in., 2c. each. Discount 70% for ⅜-in. and smaller and 65% for ½-in. and larger.
Case hardened ¼x¼-in., 6c. each, less 50%.

Rivets, button heads, ½-in., ⅝-in., 1-in. diam. x2½-in. to 4½-in., $5.00* per 100 lb. at New York warehouses; cone heads, same sizes, $5.20* per 100 lb. Rivets, ⅞x1-in. and longer, 19c. per lb., less 50%. Same discount for tinned. EXTRA per 100 lb. for 1½ to 2-in. long, all diameters, 25c.; ½-in. dia., 35c.; ⅜-in. dia., 75c.; 1-in. long and shorter, 75c., longer than 5-in., 50c.; less than 200 lb., 50c.; countersunk heads, 45c.

Washers, cast iron, ½-in., $7.00* per 100 lb. at New York warehouses; ⅝-in., $6.00* per 100 lb.

*For immediate delivery from warehouse.

Machine Requirements and Industrial Construction

Machine Tools and Equipment Wanted

Mass., Boston—K. Beaudoin, 6 Livingstone St.—miscellaneous tools and equipment for extensive repair and service garage.

Mass., Brighton (Boston P. O.) — B. Chivocci, 35 Bellvista Road—miscellaneous tools and equipment for repair and service garage.

Mass, Roxbury (Boston P. O.) — J. F. Driscoll, 66-68 Conant St.—repair tools and equipment for service garage.

Mich., Detroit—All Metal Sign Co., 8306 Brush St. (metal signs)—punch press for punching up to ½ in. holes in angle iron.

Mo., St. Louis—D. & T. Mfg. Co., 3001 La Salle St.—12 or 15 in. independent box chuck.

Mo., St. Louis—Korig Bakery, Gravois and Victor Sts.—14 in. screw cutting lathe.

N. Y., New York—Albert Bros., 11 Cannon St.—(auto body manufacturers)—300 ton tire press.

Pa., Ellwood City—Bd. of Education—machinery for shops and manual training department.

Pa., Lewistown—Viscose Co., Marcus Hook—equipment for machine and carpenter shop on Juniata River, here.

Wis., Cudahy—C. Siegel, 727 Squire Ave.—one lathe suitable for garage duty.

N. B., Campbellton—Riverside Garage, A. M. Jamieson, Pur. Agt.—repair tools and equipment for garage.

Ont., Caltano — Central Garage, J. N. Gauvin, Pur. Agt.—lathe, drill press, emery grinder.

Ont., Montmagny—La Mfg. de Meubles de Montmagny Ltd.—woodworking machinery.

Ont., Papineauville—Papineauville Lumber Co. Ltd., R. Gauthier, Secy.—saws and planers.

Ont., Port Alfred—Garage Modern Engineering, L. Perrow, Pur. Agt.—miscellaneous tools and equipment for repair and service garage.

Opportunities for Future Business

Ala., Gadsden—H. Wetter Mfg. Co., awarded contract for the construction of a new 122 x 500 ft. cast iron soil pipe plant. $250,000. Noted June 4.

Calif., Los Angeles—Taylor & Taylor, 713 West 8th St., Archts., are taking bids for the construction of a 3 story sales and service building at 21st and Figueroa Sts. for Pierce-Arrow Automobile Co. Estimated cost $200,000.

Conn., Allingtown (New Haven P. O.)—Mack Co. awarded contract for the construction of a 115 x 160 ft. addition to repair and service garage. Estimated cost $100,000.

Conn., Watertown—Watertown Mfg. Co. plans the construction of a factory addition for the manufacture of insulators. Plans completed for boiler plant. Total estimated cost $75,000. Fletcher-Thompson, Inc., 542 Fairfield Ave., Bridgeport, Archt.

Ill., Chicago — The Delta Star Electric Co., D. H. Young, Pres., 2437 Fulton St., awarded contract for the design and construction of a new unit for factory on Campbell Ave. to The Austin Co., 160 North La Salle St.

Ia., Waverly—Bd. of Education, M. M. Kingsley, Secy., plans the construction of a 2 story, 130 x 180 ft. school with manual training department. Estimated cost $175,000.

Mass., Boston — Brown & Shapiro, Old South Bldg., will build a 80 x 185 ft. repair and service garage on Northampton St. Estimated cost $75,000. Owner builds by separate contracts.

Mass., Boston—International Harvester Co. of America, 606 South Michigan Ave., Chicago, Ill., awarded contract for the construction of a 5 story, 100 x 165 ft. plant, here. Estimated cost $170,000.

Mass., Boston—North Terminal Corporation awarded contract for the construction of a 3 story, 225 x 300 ft. garage. Estimated cost $500,000.

Mass., Boston—Y. D. Service Garage, c/o L. S. Joslin, 339 Newbury St., Archt., awarded contract for the construction of a 3 story, 55 x 112 ft. repair and service garage at 345-347 Newbury St. Estimated cost $100,000. Noted May 21.

Dear Reader:

If you don't get the order when you follow up the sales leads on this page it may be because of competition by others using the same leads. Concerning one item, a manufacturer wrote us as follows:

"....We have certainly been flooded with inquiries and salesmen calling."

The reason for this is the reliability of the American Machinist. Our reporters all over the country are instructed to verify every report before sending it in.

Yours for service,

BUSINESS NEWS DEPARTMENT,
McGRAW-HILL CO., INC.,
10th Ave. at 36th St., New York.

Mass., Malden (Boston P. O.)—S. Spector, 31 York Terrace, Dorcester, plans the construction of a repair and service garage at Charles and Middlesex Sts. Estimated cost $80,000. M. Kalman, 294 Washington St., Boston, Archt.

Mass., Quincy (Boston P. O.)—Vulcan Tool Co., A Clark, Treas., 40 Liberty St., is taking bids for the construction of addition to factory. Private plans.

Mass., Wellsley (Boston P. O.)—R. G. Smith, Washington St., awarded contract for the construction of a repair and service garage at Kingsbury and Washington Sts. Estimated cost $50,000.

Mich., Detroit—Detroit Show Case Co., 1654 West Fort St., is receiving bids for the construction of a 2 story, 60 x 130 ft. factory addition for the manufacture of show cases on West 4th St. Estimated cost $50,000. B. C. Wetzel & Co., 2317 Dime Bank Bldg., Archts.

Minn., St. Paul—Northern Pacific R.R., Railway Bldg., awarded contract for the construction of a group of 6 buildings including a 50 x 112 ft. commissary building, 40 x 96 ft. storehouse, 40 x 40 ft. car shop, etc., at East 3rd and Commercial Sts. Total estimated cost $750,000. Noted Apr. 23.

Mo., St. Louis—Century Electric Co., 19th and Pine Sts., will build a 2 story, 69 x 75 ft. manufacturing plant on Olive St. Estimated cost $70,000. L. Pendleton, 119 North 7th St., Archt.

Mo., St. Louis—Pauly Jail Building Co., 2215 South DeKalb St., awarded contract for the construction of a 1 and 2 story, 124 x 146 ft. building for the manufacture of steel cells at 2218-24 South 2nd St. Estimated cost $50,000.

N. J., Orange—Riley & Downer, 36 William St., has had plans prepared for the construction of a 3 story, 60 x 100 ft. box factory, boiler house, etc. Estimated cost $75,000. Fletcher-Thompson, Inc., 542 Fairfield Ave., Bridgeport, Conn., Archt.

N. Y., Astoria—Steiner Electric Co., 590 Northern Blvd., Astoria, L. I., will soon take bids for the construction of addition to factory. Estimated cost $60,000. J. Baker, 4 Jackson Ave., Archt. and Engr.

N. Y., Ilion—Remington Typewriter Co., 374 Broadway, New York, is having plans prepared for the construction of a 4 story addition to plant, here. Estimated cost $200,000. Kinne & Frank, 7 Hopper St., Utica, Archts. and Engrs.

N. Y., New York—Armory Bd., Municipal Bldg., plans the construction of a machine shop for 9th Coast Defense. Estimated cost $20,000.

O., Akron—General Tire and Rubber Co., 1708 East Market St., will soon award contract for the construction of a 3 story, 40 x 220 ft. addition to heater room. Estimated cost $100,000. Osborn Engineering Co., 7016 Euclid Ave., Cleveland, Engr.

O., Cincinnati — Times-Star Newspaper Co., 6th and Walnut Sts., awarded contract for the construction of a 3 story, 55 x 90 and 30 x 47 ft. garage and repair shop at Central Ave. and Perry St. Estimated cost $125,000.

O., Cleveland—Economy Fixture Co., T. McWenny, Vice-Pres., 5408 Bragg Road, awarded contract for the construction of a 1 and 2 story, 32 x 67 ft. addition to furnace room at 5408 Bragg Road. Estimated cost $40,000. Noted May 7.

O., Cleveland—The Perfectlite Co., 5518 Euclid Ave., awarded contract for the construction of a 2 story, 65 x 140 ft. factory and office building on East 40th St. Estimated cost $100,000.

O., Youngstown—Truscon Steel Co., 1030 Albert St., J. Kahn, Pres., plans the construction of addition to factory on Albert St.

Pa., Lewistown—Viscose Co., Marcus Hook, awarded contract for the construction of a 111x148 ft. machine and carpenter shop on Juniata River, here.

R. I., Providence—J. G. O'Meara, 1547 Westminster St., awarded contract for the construction of a 1 and 2 story repair garage and salesroom. Estimated cost $50,000.

Tenn., Jackson—Mobile & Ohio R.R., St. Louis, Mo., awarded contract to Dwight P. Robinson Co., 125 East 46th St., New York, for unit No. 2 as follows: 78 x 375 ft. erecting shop having fifteen pits, of the lift over transverse type with a 180-ton and a 15-ton crane, seven 1-ton jib cranes, 75 x 375 ft. heavy machine shop with a 15-ton transverse crane, 50 x 375 ft. light machine shop, 75 x 154 ft. boiler shop, 50 x 150 ft. blacksmith shop, 75 x 75 ft. flue shop, 75 x 78 ft. tank shop, and 50 x 75 ft. wheel shop, here. Estimated cost $1,250,000.

Wis., Marshfield—Felker Bros. Mfg. Co., Depot and Chestnut Sts., awarded contract for the construction of a 1 and 2 story, 68 x 77 ft. plant for the manufacture of steel tanks. Estimated cost $40,000. Noted May 7.

Wis., Prairie du Sac — Wisconsin River Power Co., 16 North Carroll St., Madison, awarded contract for a 50 x 50 ft. shop, here. Estimated cost $40,000.